

# MONTANA

## Forestry Best Management Practices Monitoring



## 2010 FORESTRY Best Management Practices FIELD REVIEW RESULTS

Department of Natural Resources & Conservation  
Forestry Division • Missoula, MT 59804-3199

# **MONTANA FORESTRY BEST MANAGEMENT PRACTICES MONITORING**

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## **2010 FORESTRY BMP FIELD REVIEW REPORT**

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# **ACKNOWLEDGMENTS**

In 2010 the Forestry Assistance Bureau, Forestry Division of the Montana Department of Natural Resources and Conservation once more undertook the task of completing the Forestry Best Management Practices (BMP) Field Reviews. The name of this process was changed from “AUDITS” to “FIELD REVIEWS” to more accurately reflect what was really being done.

The Division graciously acknowledges the many people who gave their time and energy toward the review effort. Thank you to all of the Field Review Team Members who traveled extensively, worked long days in the field, and tackled many difficult decisions in a professional manner. Thanks also go to the Environmental Quality Council and Governor’s Office, to all who supplied information to select the sites, and to those who gave access to private lands. Thanks to the representatives from Industry, the U.S. Forest Service, the Bureau of Land Management, the Department of Natural Resources and Conservation Trust Land Management Division, and the Family Forest Landowners for their cooperation in providing field review site information and/or team members. Special thanks to Carol Heath for their assistance in organizing the 2010 BMP Field Reviews.

Roger Ziesak

## EXECUTIVE SUMMARY

The Forestry Best Management Practice (BMP) field review process is used to evaluate whether BMPs are being applied, applied correctly, and if they are effective in limiting non-point source pollution from logging operations in Montana. The Montana Department of Natural Resources and Conservation (DNRC), Forestry Division, evaluates forest practices for BMP implementation every two years, and reports the findings to the Montana Environmental Quality Council (EQC). This report summarizes the findings of Montana's 2010 Forestry BMP Field Reviews, and follows similar reviews and reports that have been done biennially since 1990.

In 2010, three interdisciplinary teams conducted the field reviews. Each team was composed of a fisheries biologist, a forester, a hydrologist, a representative of a conservation group, a road engineer, a soil scientist, and a non-industrial private forest (NIPF) landowner or logging professional. DNRC used established site selection criteria to select forty-five (45) new timber harvest sites harvested in 2008 or 2009. The field review teams evaluated a maximum of fifty-eight (58) BMPs, 49 of which are forestry BMPs and the remaining 9 are Streamside Management Zone (SMZ) BMPs, at each site, rating application and effectiveness for each BMP on a five-point scale.

A total of 45 field review sites were evaluated for **BMP Application**. Field Review results showed that across all ownerships, **BMPs were properly applied 97% of the time**. Although many harvest sites had at least one instance where a BMP was inadequately applied, a majority of these departures were minor (87%) and did not cause erosion or deliver material to a stream. Eleven percent (11%) of the sites had one or more major BMP departures in application. In the 2008 field reviews, 19% had major BMP departures in application. The application of eight high risk BMPs were also evaluated separately because these are among those most important for protecting soil and water resources. Ninety-Three percent (93%) of these high risk BMPs were properly applied.

The field review teams also evaluated the same 45 sites for **BMP effectiveness**. Field review results showed that across all ownerships, **BMPs were effective in protecting soil and water resources 98% of the time**. Sixteen percent (16%) of all sites had some minor departures in BMP effectiveness. This compares with 48% in 2008. Minor departures in effectiveness produce minor impacts to soil and water resources; eroded material reaches draws, but not streams. Thirteen percent (13%) of the sites had one or more major departures in BMP effectiveness compared to 19% in 2008. Ninety-six (96%) percent of the eight high risk BMPs evaluated were rated as providing adequate protection to soil and water resources.

The greatest frequency of departures from the BMPs, and the most identified impacts, were associated with road maintenance and road surface drainage. This report includes a list of the most problematic BMPs in Table 16 on page 22.

The Field Review teams also evaluated application and effectiveness of the Montana SMZ Law. For both application and effectiveness, a total of 16 SMZ Rules departures noted (10 for application and 6 for effectiveness) out of the 670 rated. Application rating departures were six rated as minor and four as major. Effectiveness rating departures were five rated as minor and one as major.

## Summary of BMP and SMZ Application and Effectiveness, by Ownership Group

Practice	DNRC	Federal	Industry	NIPF	Totals
BMP Application	99%	96%	98%	98%	97%
BMP Effectiveness	99%	98%	99%	99%	98%
SMZ Application	100%	94%	100%	98%	97%
SMZ Effectiveness	100%	95%	98%	100%	98%

## Comparison of BMP Field Review Results – 1990 through 2010

Category	2010	2008	2006	2004	2002	2000	1998	1996	1994	1992	1990
Application of practices that meet or exceed BMP requirements.	97%	97%	96%	97%	96%	96%	94%	92%	91%	87%	78%
Application of high risk practices that meet or exceed BMP requirements.	93%	90%	89%	89%	90%	92%	84%	81%	79%	72%	53%
Number of sites with at least one major departure in BMP application.	5 of 45 (11%)	8 of 42 (19%)	4 of 44 (9%)	5 of 39 (13%)	10 of 43 (23%)	4 of 42 (10%)	8 of 47 (17%)	12 of 44 (27%)	17 of 46 (37%)	20 of 46 (43%)	27 of 44 (61%)
Average number of departures in BMP application, per site.	0.87	1.19	1.52	1.30	1.80	1.40	2.00	3.00	3.90	5.60	9.00
Percentage of practices providing adequate protection.	98%	97%	97%	99%	97%	98%	96%	94%	93%	90%	80%
Percentage of high risk practices providing adequate protection.	96%	91%	92%	95%	92%	93%	89%	86%	83%	77%	58%
Number of sites having at least one major / temporary or minor / prolonged impact.	7 of 45 (16%)	8 of 42 (19%)	7 of 44 (16%)	10 of 39 (25%)	15 of 43 (35%)	9 of 42 (21%)	12 of 47 (26%)	15 of 44 (34%)	13 of 46 (28%)	17 of 46 (37%)	28 of 44 (64%)
Average number of impacts per site.	0.47	1.02	1.05	0.56	1.30	1.00	1.50	2.30	3.00	4.60	8.00

# **INTRODUCTION**

The forest lands of Montana are also the headwaters for several major river basins and produce large quantities of high quality water. This water nurtures some of the West's best fisheries and is used for irrigation and livestock, as well as for domestic, recreational and industrial purposes. These same lands grow the timber resources that sustain the forest products industry, one of Montana's major industries. All products from Montana's 22.5 million acres of forested land contribute in an essential manner to Montana's economy and way of life.

Montana's water quality protection program for forestry involves a combination of regulatory and non-regulatory approaches. Since the 1970's, non-regulatory Forestry Best Management Practices have provided guidance as minimum water quality protection standards for forestry operations. In 1987 Congress amended the Clean Water Act and added Section 319 to address non-point sources of pollution. Section 319 directed all states to develop non-point source pollution plans to address non-point source pollution problems. The Forestry BMPs provide Montana's Section 319 compliance.

At this same time, concern over the impacts of forest management on Montana's watersheds prompted the 1987 Montana Legislature to pass House Joint Resolution 49. This resolution directed the Montana Environmental Quality Council (EQC) to study "how current forest management practices are affecting watersheds in Montana." (Zackheim, 1988) The EQC established a BMP technical committee that developed Montana's first statewide forestry BMPs in 1987. In 1989, after two years of work, an interdisciplinary working group (BMP Working Group) released the revised Forestry Best Management Practices. Since that time, the BMP Work Group has overseen the biennial process. In the interim between the 1996, 1998, 2000, 2002, and 2008-2010 field review cycles the BMP Work Group reviewed and revised the 1989 BMPs. The last revision was to address biomass in the BMPs – this change is minor and has no direct impact on the methodology used in the field review process. The 2004 version of the Best Management Practices for Forestry in Montana (Appendix A) was adopted for use in the 2010 field reviews.

Forestry BMP field reviews have been conducted previously in Montana. As part of HJR-49, field review teams conducted the first statewide assessment of forest practices for BMPs during the summer of 1988 (Zackheim, 1988). In 1989 the University of Montana, under the Flathead Basin Water Quality and Fisheries Cooperative, reviewed more sites for BMPs in the Flathead River drainage (Ehinger and Potts, 1990). The Montana Legislature has directed DNRC to conduct a further series of statewide BMP field reviews in 1990, 1992, 1994, 1996, 1998, 2000, 2002, 2004, 2006, 2008, and 2010 (Schultz, 1990 and 1992; Frank, 1994; Mathieus, 1996; Fortunate, et al., 1998; Ethridge and Heffernan, 2000; Ethridge, 2002; Ethridge, 2004; Rogers, 2006; Ziesak 2008).

Forestry BMPs, if properly applied, can limit non-point source pollution--the kind of diffuse pollution that forestry operations can produce, such as sediment from a road or timber harvest. The BMP field review process has been consistently used since 1990 to evaluate whether BMPs are being properly applied and if they are effectively limiting non-point source pollution.



Prior to 1989, forestry water quality was addressed through a voluntary approach as part of the State's 1988 non-point source assessment and management plan. In 1989 the Montana Legislature enacted the BMP Notification Law (76-13-101 MCA), which requires private landowners to notify DNRC prior to harvesting timber. DNRC then provides information and technical assistance on how to apply BMPs in the logging operation. Under this law, forestry BMP information is sent to landowners. Implementation of Forestry BMPs is administered within a non-regulatory framework.

Since October 1991 the Streamside Management Zone (SMZ) Law (77-5-301 307 MCA) has regulated forest practices along streams. This law prohibits certain forest practices along stream channels and directs suitable streamside management practices. The SMZ Rules (36.11.301 - 310 ARM) became effective March 15, 1993 and were intended to help define and clarify the SMZ law. The 1992 BMP field reviews did not evaluate compliance with the SMZ law because most operations reviewed were completed prior to the effective date of the rules. Beginning in 1994, the field reviews were designed to provide information on the application and implementation of the SMZ law and rules, using a supplemental SMZ questionnaire. In 1998 the format and five-point scale used to evaluate the BMPs for application and effectiveness was adopted for evaluating application and effectiveness of the SMZ law and rules.

The BMP field review process, which the EPA calls BMP implementation monitoring, is a widely used means of evaluating forest practices. Implementation monitoring is an acceptable surrogate for water quality monitoring, a more quantitative, time consuming and expensive approach. Water quality varies naturally due to variable geology, landforms, soils, and climatic events. Due to this variability, investigators have to collect large numbers of samples over a long period of time to accurately characterize water quality.

In Montana investigators use qualitative implementation field reviews to find out if BMPs are being applied and whether they are controlling erosion. Since BMPs are recognized by state and federal legislation as a method to control non-point source pollution, it makes sense to check the application and effectiveness of BMPs as part of such a program. States are increasingly relying on qualitative surveys, using interdisciplinary teams to assess forest practices on-site to monitor their silvicultural non-point source control programs (NCASI, 1988). California, Idaho, Oregon, Utah, Minnesota, Washington, South Carolina, Texas, and Florida all use a similar qualitative approach to assess the control of non-point source pollution from forest practices.

Montana, through the DNRC, has appointed a technical work group that has overseen the BMP process since its inception and provides recommendations to DNRC. The work group members represent a broad range of interests in forestry in Montana. Several members also serve on the field review teams, and several have been involved with the program since 1988.

# **METHODS**

## **Objectives**

BMP field reviews have been conducted every two years beginning in 1990; 2010 represents the eleventh cycle. The 2010 field reviews were conducted with similar objectives and criteria as the previous field reviews in order to produce comparable results.

In 2010, the objectives of the BMP field reviews were to:

1. Determine if BMPs are being applied on timber harvest operations.
2. Evaluate the general effectiveness of BMPs in protecting soil and water resources.
3. Provide information on the implementation of the SMZ law and rules and assess general effectiveness of SMZs in protecting water quality.
4. Provide information to focus future educational or study efforts by identifying subjects and geographic areas in need of further attention or investigation.
5. Provide information on the need to revise, clarify, or strengthen BMPs.

## **The Study Area**

The State of Montana is the study area. For 2010 the state was broken into three geographical regions, Northwest, West, and Central/Eastern. For administrative ease, the regional breaks are located on county lines.

## **Sample Size and Distribution**

Historically the target for the number of sites to be reviewed was set at 45. This number was based on the interaction between the number of days the volunteer field review team members could be expected to commit to the review process and the number of field reviews a team could reasonably conduct in one day. The maximum time commitment for field review team members was established at 10 days. This is for all review-related activities, which includes calibration training, conducting the on-the-ground field reviews and a post-field season workshop. It was determined that a request exceeding 10 days would likely jeopardize the ability of individuals to participate, thus restricting the ability to field the desired number of fully-staffed teams. A field review team can be expected to complete one or two reviews per day depending on the regional distribution of sites and the travel time between sites. Based on the above expectations and assumptions, the target number was set at 45.

The targeted 45 field review sites are distributed across the state by geographical region (see Study Area above) and land ownership group. The field review process recognizes four ownership groups: State of Montana Trust Lands (DNRC), U.S. Forest Service/Bureau of Land Management lands (Federal), private industrial lands (Industry) and non-industrial private forest lands (NIPF). The basis for field review site distribution is the proportion of the total statewide harvest volume that is harvested within each region by each ownership group. The 45 sites are

allocated proportionally among the regions. Harvest volumes were obtained from the 2009 State of Montana Cut By County Report and USFS, BLM and DNRC annual harvest volume records.

A total of 45 sites were reviewed during the 2010 BMP cycle (see Table 1 for historical site information). Each of the original selected sites participated in the field review process. No substitutions were needed.

In general, it still is difficult to obtain the desired number of NIPF field review sites. Fewer NIPF sites are meeting the minimum and higher priority criteria (see Site Selection discussion below for criteria details). There is a continuing reduction in the number of NIPF landowners constructing roads and installing stream-crossing culverts. This trend can impact the number of NIPF sites that meet the minimum criteria.

The 45 sites are a representative sample of logging operations conducted in Montana since 2008 **that meet specific selection criteria** (see Site Selection, below). The selection criteria restrict the sample to those sites where on-the-ground timber harvest and timber management-related activities has the opportunity to impact water quality.

**Table 1**  
**Historical Number of Sites Reviewed by Ownership Group**

<b>Ownership Group</b>	<b>2010</b>	<b>2008</b>	<b>2006</b>	<b>2004</b>	<b>2002</b>	<b>2000</b>	<b>1998</b>	<b>1996</b>	<b>1994</b>	<b>1992</b>	<b>1990</b>
DNRC	6	6	5	4	5	5	5	5	5	5	5
Federal	16	8	5	9	5	9	12	12	14	16	16
Industrial	15	17	22	19	21	18	18	14	14	16	16
NIPF	8	11	12	7	12	10	12	13	13	9	7
Total	45	42	44	39	43	42	47	44	46	46	44

See Appendix B for the list of reviewed sites.

## **Site Selection**

In January of 2010 DNRC sent Industry, Federal and DNRC ownership group representatives a letter requesting potential BMP field review candidate sites. Each letter included a BMP Field Review Site Information Form (see Appendix D) to be completed for each harvest operation that met the first tier or minimum selection criteria (see page 7). As with past information requests, these ownership groups were very cooperative and provided essential information to DNRC. To obtain potential field review site information for NIPF ownership, DNRC searched its Hazard Reduction Agreements database and sent out letters to NIPF landowners of qualified sites asking if they would participate in the field review process. A postcard was included in the mailing for returning a response or responses could be emailed or phoned in.

The following two pages outline the new selection criteria as it was used to determine eligibility. These criteria conform to a legislative audit of the procedure that was completed in 2008.

### **Minimum Criteria**

- Sites harvested within two years prior to the field review (2008 and 2009).
- Minimum harvest size is 5 acres.
- Minimum size and volume per acre:
  - west-side sites – 3,000 or more board feet per acre removed
  - east-side sites – 1,500 or more board feet per acre removed

A portion of the sale must be located within 200 feet of a stream **or** have at least one Class I or II stream crossing on the road system associated with the harvest (access route and/or haul route) located on the ownership group's property within the field review project area **or** stream crossings are located on road for which the ownership group being reviewed had some maintenance responsibility that was associated with the harvest/sale that is being reviewed.

This is essentially privately owned roads (could have public on them though such as USFS roads) accessing the sale or harvest area that is being reviewed, no county or state roads.

**Prioritization Criteria** – each site submitted would be given points based on the following matrix and the points for each site totaled.

**Explanation:** Relative Risk Rating – this was developed as a more equitable and trackable approach to identifying higher risk sites. Each site's criteria would be assigned a point value – the more total points the higher the risk.

- |   |          |
|---|----------|
| • Multiple new or replacement class 1 or 2 stream crossings | 5 points |
| • Single new or replaced Class 1 or 2 stream crossing       | 4 points |
| • New road construction                                     | 3 points |
| • Reconstruction  | 2 points |
| • SMZ Harvest   | 2 points |
| • Existing stream crossings                                 | 1 point  |
- a. For the purposes of assigning risk - all stream crossings are class I & II only. Class 3 streams are not considered for risk factors but would be taken into account on the ground.
- b. The only stream crossings considered in determining risk are the stream crossings on the landowner's property.

Note: new or replaced stream crossings must have been implemented in association with the harvest project within 5 years of the review year.

### **Streams**

**Stream and Streamside Management Zone (SMZ):** Definitions are from the Montana SMZ Administrative Rules; 36.11.301 2006 version).

For the purpose of BMP field reviews an SMZ must have an associated stream as defined in the SMZ law.

**Definition of a Stream** - A feature with a defined channel, definite banks or a sandy or rocky bottom, **and** flows water either intermittently or continuously.

**Class 1 Stream** – Any stream with fish. OR Any stream that flows for more than 6 months per year and flows into another stream, lake or other body of water.

**Class 3 Stream** – Does **not** have fish. Flows less than 6 months per year **and** does not flow into another stream, lake or other body of water.

**Class 2 Stream** – All other streams that do not meet the definitions for Class 1 or Class 3 streams.

### **Roads**

**New Construction** – Any roads constructed after January 1, 2005 used to access associated harvest areas.

**Reconstruction** – Reconstructing an existing road to a different set of design standards, such as widening roads, altering cut or fill slopes, culvert installation and/or replacement. For the purpose of field reviews, road work consisting of the installation of road drainage features and/or general road maintenance with no other reconstruction activities should not be submitted as “reconstruction”.

**Table 2**  
**Percentage of Sites Meeting High Hazard Criteria**

<b>Ownership Group</b>	<b>Number of Sites</b>	<b>Number of High Risk Sites</b>	<b>Percentage of High Risk Sites</b>	<b>Number of Sites With Riparian Harvest</b>
DNRC	6	4	67%	6
Federal	16	5	31%	14
Industry	15	5	33%	12
NIPF	8	2	25%	5
All Sites	45	16	36%	37

An associated site selection issue is that of access to potential field review sites. BMP field reviews are voluntary, and thus permission to access a site must be granted by the landowner group or, in the case of NIPF lands, the individual landowner. The DNRC, Federal and Industry ownership groups have all agreed to unrestricted access to BMP field review sites, and access is not an issue. In the case of non-industrial private land, DNRC must obtain permission from each individual landowner prior to conducting the field review on their property. In order to accomplish this, DNRC made contact by initial mailing containing a letter, a brochure explaining the process and a pre-paid post card to return to DNRC notifying us if they agree to participate or decline. After selection a follow-up notification and/or telephone call to confirm permission and access to field review their property was made. If permission and access was confirmed, a follow-up call was made by the team leader to finalize the field review date. Landowners were encouraged to attend.

**The sample size and sites selected DO NOT represent a sample of all timber harvest operations in Montana - ONLY those meeting site selection criteria. The selected sites are those where timber harvest is located in proximity to streams and therefore has the greatest potential for non-point source pollution to occur.**

## **The Field Review Teams**

Three field review teams were formed to conduct the 2010 field reviews--one for the northwestern, one for the western, one for the central/eastern part of the state. These teams were composed of seven members--a fisheries biologist, a forester, a hydrologist, a conservation group representative, a road engineer, a soil scientist, and a shared position of logging professional or representative of non-industrial private forest landowners (NIPF). A member of each field review team was assigned to lead the team. The team leader was responsible for providing general leadership and direction as well as filling out the official rating form and overseeing the logistics of the team. Team members were employees of federal and state agencies, private industry, conservation organizations, independent consultants, and volunteers.

One training session was conducted prior to the actual field reviews. This session served as a refresher for those with previous experience and as a calibration for new and old team members. All team members, including alternates, were strongly encouraged to attend. The goal was to have the field review teams establish a consistent method of rating BMPs that would carry through the field review process. Team members and alternates met for several hours of classroom instruction on the BMP field review process and then evaluated a sample field review site in the field looking at specific stations with specific issues. Team members shared their results and identified and discussed differences and ways to improve overall consistency. See Appendix D for a complete list of team members.

## **The Rating Form**

The 2010 field review teams used a rating form similar to that of previous reviews. The guide for rating application and effectiveness was the same as that used in the previous field reviews. The field review teams evaluated a maximum of 49 BMP practices and 12 SMZ practices at each site. The rating of application and effectiveness for each was done on a five-point scale, as in the past. See Appendix E for a copy of the rating form.

The field review team rated the application of BMPs by first noting if the BMP was applicable to the site and, if so, whether it was applied to the correct technical standard, at the correct frequency, and in the proper locations. The field review teams utilize a decision tree (See Appendix H) to help rate application and effectiveness and, again, to work toward rating consistency.

Lack of adequate application or misapplication are departures from the BMPs. The rating guide for the application of BMPs is:

- 5 - Operation exceeds requirements of BMP.
- 4 - Operation meets requirements of BMP.
- 3 - Minor departure from intent of BMP.
- 2 - Major departure from intent of BMP.
- 1 - Gross neglect of BMP.

The following description of the rating guide is adapted from Ehinger & Potts, 1990. The 4 rating is self-explanatory. The 3 rating, minor departure, applies to departures of small

magnitude distributed over a localized area, or over a larger area where potential for impact is low. The 2 rating, major departure, applies to departures of large magnitude or to BMPs being repeatedly neglected. The 1 rating, gross neglect, applies where risks to soil and water resources were obvious, yet there was no evidence indicating that operators had applied BMPs to protect these resources.

A “5” for Effectiveness is defined by Potts and Ehinger as “Improved protection of soil and water resources over pre-project conditions.” Thus, if a BMP is applied adequately and its application leads to improved protection over pre-project conditions, the effectiveness rating for that practice would be a “5.” In actuality the Montana field review rating policy does not exactly follow the Potts and Ehinger Effectiveness “5” definition. It was decided that if a BMP practice was applied in such a way that the requirements of the BMP were met, regardless of improvement over pre-existing conditions, this would provide adequate protection and thus receive an effectiveness rating of “4.” Effectiveness ratings of “5” are in fact only given if the protection provided is extraordinary or more than adequate; for example, installing a bridge for fish passage when a CMP would have met the BMP requirement or obliterating an unnecessary road rather than merely putting in road drainage or gating the road.

The effectiveness rating addresses how well the application of the applied BMP performed at limiting resource impacts and keeping soil out of water. This rating answers questions concerning impacts; for example, "Has the application or misapplication of a particular forest practice increased the likelihood of, or actual occurrence of, sediment delivery to streams?" Lack of effectiveness results in impacts.

The rating guide for effectiveness was:

- 5 - Improved protection of soil and water resources over pre-project condition.
- 4 - Adequate protection of soil and water resources.
- 3 - Minor and temporary impacts on soil and water resources.
- 2 - Major and temporary, or minor and prolonged, impacts on soil and water resources.
- 1 - Major and prolonged impacts on soil and water resources.

The BMP Working Group defined these terms prior to the 1990 field reviews to help the field teams use them consistently:

- Adequate**--Small amounts of material eroded; material does not reach draws, channels, or floodplain.
- Minor**--Some material erodes and is delivered to draws, but not to stream.
- Major**--Material erodes and is delivered to stream or annual floodplain.
- Temporary**--Impacts lasting one year or less; no more than one runoff season.
- Prolonged**--Impacts lasting more than one year.

Effectiveness ratings of “5” follow the same methodology as for Application. The effectiveness of the applied BMP exceeds what would be necessary to adequately protect soil and water resources.

Occasionally a BMP did not apply on a site. In some cases the particular activity did not occur or was not complete, in others, the field review team could not rate the BMP at the time of the review - BMPs having to do with timing of operations during the harvest cannot be judged post-

harvest. When these situations occurred, the team noted on the form that the practice did not apply and no rating was given. In 2010, a maximum of 2,205 practices (45 sites, 49 BMPs) could have been rated. Sixty-seven percent of all possible BMP's were rated (1,469 of 2,205). Eighty-two percent of all possible SMZ practices were rated (335 of 407).

In addition to the 49 BMPs evaluated, the field review form contains two general questions in Section VII (Appendix E) addressed by the field review team. One question addresses the issue of overall reductions in sediment delivery to streams as a result of road improvements to existing road systems. The second addresses the third-party road system. These are discussed later in this report.

## **Field Review Site Inspections**

The teams conducted the field reviews from late June through mid August of 2010. The field routine consists of team members, landowner representatives and observers meeting at a central location prior to each review. Teams and observers then travel to the field review site. When in the general area of the site, but before actually entering the road system to access the harvest area or the harvest area itself, there is a stop to discuss the specifics of the field review process. The team leader provides maps and field review forms. Usually the landowner/logger, or a representative of either the landowner/logger, briefs the team by giving background information on the silvicultural prescription, time of operation, and associated practices. All decisions regarding which roads, SMZs, new culvert installations and harvest units to be reviewed are determined before the team enters the subject road system or harvest area. Once on site, all team members walk the site as a group, and review BMP practices conducted in the selected areas. Teams typically spend about two hours inspecting, discussing, and then rating each site. Observers attending the field review may give feedback when requested, but are not allowed to participate in the ratings determination process or to lobby for a particular rating.

## **Limitations of the Field Review Methods**

(in part, adapted from Idaho DHW, 1989)

In analyzing field review results, readers need to consider the limitations of the techniques used in the field review. The review technique consists of a one-time field inspection and assessment. This approach documents erosion and sedimentation problems occurring in the first two years after harvest. This is generally the critical period for erosion associated with timber harvests. Some practices conducted during harvest cannot easily be evaluated during a post-harvest field review and are not considered during the field review. The assessment is based on visual appraisals of practices and impacts to surface soils and streams. The results are a "snapshot in time" of the practices and subsequent impacts. They do not necessarily reflect future impacts. During the 1998 field reviews, sites previously reviewed in 1996 and 1994—i.e., four- to six-year-old sites—were examined for long-term impacts. This information can be found in the 1998 Forestry BMP Audit Report (Fortunate et. al.)

Sites are split among the three teams. Although rating inconsistency between teams should not be overlooked, its effect is likely minor due to the interaction between teams and the continuity of experienced team members. DNRC monitors each team to evaluate and promote consistency.



# RESULTS

This section presents the results of the 2010 BMP field reviews. Results will be presented in four parts: BMP Application, BMP Effectiveness, High Risk BMPs, and SMZ Results.

Results are in three formats: summary data for BMP practices (Tables 3 and 6), summary data for reviewed sites (Tables 4 and 7), and a listing of the specific BMPs that incurred departures and impacts (Tables 5 and 8). For reference, Appendix H presents a summary tabulation of ratings by individual BMP.

## Application of BMPs

The application rating measures whether the BMP was applied and whether it was applied to the correct standards the appropriate number of times and in the proper locations. See also "The Rating Form" section on page 9. Field review teams rated a total of 1,469 practices to assess how landowners and operators applied BMPs. Tables 3, 4 and 5 present results relevant to BMP Application.

**Table 3**  
**Application of BMPs to All Rated Practices**  
**by Ownership Group and Rating Category**

Ownership Group	# Practices Rated	Percentage (%) of Practices Rated As			
		Meet or Exceed	Minor Departures	Major Departures	Gross Neglect
<b>DNRC</b>	227	99%	1%	0%	0%
<b>Federal</b>	554	96%	3%	1%	0%
<b>Industrial</b>	468	98%	2%	0%	0%
<b>NIPF</b>	220	97%	3%	0%	0%
<b>All Sites</b>	1,469	97%	2%	<1%	0%

Practices were applied correctly 97 percent of the time (Table 3). In terms of departures, of the 1,469 practices evaluated, about 2.6% of the practices had departures; 34 ratings of 3 (**minor departures**) and 5 ratings of 2 (**major departures**). There were no ratings of 1 (**gross neglect**).

Table 4 details the **percentage of sites with application departures** and average number of departures per site. It shows that 51% of sites reviewed were producing **minor departures** at an average of 1.48 departures per site. Eleven percent of all sites were producing **major departures** at an average of 1.04 per site. Forty-nine percent of sites had **no departures**.

**Table 4**  
**Field Review Sites with Departures from BMP Application**  
**with the Average Number of Departures per Site**

		Percentage of Sites w/out Departures	Percentage (%) of Sites with Departures			Average Number of Departures Per Site*		
Ownership Group	Total # of Sites	Adequate or Improved Protection	Minor	Major	Gross	Minor	Major	Gross
<b>DNRC</b>	6	67%	33%	0%	0%	0.33	0.00	0.00
<b>Federal</b>	16	44%	56%	13%	0%	1.06	0.31	0.00
<b>Industrial</b>	15	47%	47%	0%	0%	0.60	0.00	0.00
<b>NIPF</b>	8	63%	37%	0%	0%	0.75	0.00	0.00
<b>All Sites</b>	45	51%	47%	4%	0%	0.76	0.11	0.00

\* Number of Departures/Total Number of Sites

In Table 4, each category of departures must be considered separately, since a site may have departures in more than one category.

Table 5 identifies the specific BMPs where departures occurred. The list is ordered from most to fewest departures.

**Table 5**  
**Individual BMP Practices\* Where Application Departures Occurred**  
**with the number of Departure Ratings Given**

SECTION	BMP SUBSECTION	BMP	2 Rating Departures	3 Rating Departures	Total Departures
III	C	1	1	7	8
III	C	7	2	3	5
III	E	2	0	4	4
IV	A	5	0	3	3
V	D	1	0	3	3
V	C	4	0	3	3
III	D	5	0	2	2
III	D	8	0	2	2
III	C	3	0	1	1
III	C	4	0	1	1
III	C	5	0	1	1
III	D	6	0	1	1
IV	A	6	1	0	1
IV	B	1b	0	1	1
IV	B	2	0	1	1
IV	B	4	1	0	1
IV	B	5	0	1	1
<b>TOTALS</b>			<b>5</b>	<b>34</b>	<b>39</b>

\* See Appendix A for a description of individual BMPs.

## **Effectiveness of BMPs**

The effectiveness rating evaluates how well BMPs protected soil and water resources. See page 10 for further explanation of the effectiveness rating. The field review teams evaluated a total of 1,469 practices for effectiveness. Table 6 provides a summary of the effectiveness of all practices reviewed by ownership group.

Adequate protection was provided 98% of the time. In terms of impacts (Table 7), of 1,469 practices evaluated, 21 practice departures had impacts; 8 ratings of 3 (**minor temporary** impacts), 11 ratings of 2 (**major temporary or minor prolonged** impacts), and 2 ratings of 1 (**major and prolonged** impacts).

**Table 6**  
**Effectiveness of BMPs for All Rated Practices**  
**by Ownership Group and Rating Category**

Ownership Group	Number of Practices Rated	Percentage (%) of Practices Rated As			
		Adequate Protection	Minor/Temp. Impacts	Major/Temp. Minor/ Prolonged	Major/ Prolonged
<b>DNRC</b>	227	99%	0%	<1%	0%
<b>Federal</b>	554	97%	<1%	2%	<1%
<b>Industrial</b>	468	99%	1%	<1%	0%
<b>NIPF</b>	220	99%	<1%	0%	0%
<b>All Sites</b>	1,469	98%	<1%	1%	<1%

Table 7 lists the percentage of sites with impacts and average number of impacts per site. The table shows that 43 percent of the sites reviewed had **minor/temporary** impacts at an average of 0.74 impacts per site. Nineteen percent (19%) of all sites had **major/temporary** impacts at an average of 0.28 per site.

**Table 7**  
**Field Review Sites with Impacts (BMP Effectiveness)**  
**and the Average Number of Impacts per Site**

		Percentage (%) of Sites w/out Impacts	Percentage (%) of Sites With Impacts			Average Number of Impacts per Site*		
Ownership Group	Total # of Sites	Adequate or Improved Protection	Minor/ Temp.	Major/Temp. Minor/ Prolonged	Major/ Prolonged	Minor / Temp.	Major/Temp. Minor/ Prolonged	Major/ Prolonged
<b>DNRC</b>	6	83%	0%	17%	0%	0.0	0.17	0.0
<b>Federal</b>	16	56%	13%	25%	13%	0.13	0.56	0.13
<b>Industrial</b>	15	73%	20%	7%	0%	0.27	0.07	0.0
<b>NIPF</b>	8	75%	25%	0%	0%	0.25	0.0	0.0
<b>All Sites</b>	45	69%	16%	13%	4%	0.18	0.24	0.05

\* Number of Impacts/Total Number of Sites

Table 8 identifies the specific BMPs where impacts occurred. The list is ordered from most to fewest departures.

**Table 8**  
**Individual BMP Practices\* Where Effectiveness Impacts Occurred**  
**With the Number of Departure Ratings Given**

<b>Section</b>	<b>BMP Subsection</b>	<b>BMP</b>	<b>1 Rating</b>	<b>2 Rating</b>	<b>3 Rating</b>	<b>Total Effects Impacts</b>
III	C	7	1	3	1	5
III	C	1	1	2	0	3
III	D	5	0	1	1	2
V	C	4	0	1	1	2
V	D	1	0	0	2	2
III	C	5	0	1	0	1
III	D	6	0	0	1	1
III	D	8	0	1	0	1
III	E	2	0	0	1	1
IV	A	6	0	1	0	1
IV	B	1b	0	0	1	1
IV	B	4	0	1	0	1
<b>TOTALS</b>			<b>2</b>	<b>11</b>	<b>8</b>	<b>21</b>

\*See Appendix A for a description of individual BMPs.

Table 9 provides an overall numeric summary by ownership group of all departures and impacts.

**Table 9**  
**Overall Summary of Reviewed BMP Practices**

Practices Information					Application			
Group	Reviewed Sites	Total Practices Possible *	Number Practices Not Rated **	Number Practices Rated	Exceeds (5)	Minor (3)	Major (2)	Gross Neglect (1)
DNRC	6	294	67	227	3	6	0	0
Federal	16	784	230	554	2	17	5	0
Industry	15	735	267	468	0	9	0	0
NIPF	8	392	172	220	1	2	0	0
<b>Total</b>	<b>45</b>	<b>2,205</b>	<b>736</b>	<b>1,469</b>	<b>6</b>	<b>34</b>	<b>5</b>	<b>0</b>
Effectiveness								
Group	Exceeds (5)	Minor/Temp (3)	Major/Temp Minor/Prolonged (2)	Major Prolonged (1)				
DNRC	3	0	1	0				
Federal	1	3	9	2				
Industry	1	4	1	0				
NIPF	1	1	0	0				
<b>Totals</b>	<b>6</b>	<b>8</b>	<b>11</b>	<b>2</b>				

\* Total practices possible based on the number of field review sites for each ownership.

\*\* Practices not rated because the practice did not apply to the site. For example there was no new culvert installation.

## **High Risk BMPs**

Percentages alone will not give a clear picture of the application and effectiveness of Montana's forestry BMPs. Even a low percentage of misapplied BMPs can still result in major impacts. Additionally, all practices evaluated can affect water quality, but the magnitude of their potential impacts can vary greatly. For example, drainage from a skid trail half a mile from a stream may not have as direct an impact on water quality as providing adequate road surface drainage at a stream crossing. In an effort to gain insight regarding the practices with the higher potential to directly impact water quality, eight high risk BMPs have been identified and analyzed separately. They are among the most important for protecting Montana's watersheds. They include:

### **BMP Number**

### **Practice Description**

- |         |   |
|---------|---|
| III.C.1 | Provide adequate road surface drainage for all roads.                           |
| III.C.7 | Route road drainage through adequate filtration zones before entering a stream. |
| III.D.2 | Stabilize erodible soils (i.e., seeding, benching, mulching).                   |
| III.E.2 | Maintain erosion control features (dips, ditches and culverts functional).      |
| IV.A.5  | Design and locate skid trails to avoid concentrating runoff.                    |
| IV.B.5  | Adequate drainage for temporary roads, skid trails, fire lines.                 |

- IV.C.8 Limit water quality impacts of prescribed fire.  
V.C.4 Prevent erosion of culvert and bridge fills (i.e., armor inlet and outlet).

The results for application and effectiveness of the eight high risk BMPs are presented in Tables 10 and 11. Table 12 shows a comparison between All BMPs and High Risk BMPs.

Table 10 shows the BMP application for the eight high risk BMPs. The percentage of practices with departures is higher for the high risk group (7% vs. 3%) than for all reviewed practices, as shown in Table 12.

**Table 10**  
**Application of High Risk BMPs**  
**by Ownership Group and Rating Category**

Ownership Group	Number of Practices Rated	Percent (%) Practices Rated As			
		Adequate Application	Minor Departures	Major Departures	Gross Neglect
DNRC	43	98%	2%	0%	0%
Federal	109	87%	10%	3%	0%
Industrial	101	95%	5%	0%	0%
NIPF	49	96%	4%	0%	0%
All Practices	302	93%	6%	1%	0%

Table 11 shows the effectiveness of the eight high risk BMPs. The percentage of practices with departures is higher for the high risk group (4% vs. 2%) than for all reviewed practices, as shown in Table 12.

**Table 11**  
**Effectiveness of High Risk BMPs**  
**by Ownership Group and Rating Category**

Ownership Group	Number of Practices Rated	Adequate Protection	Minor/Temp. Impacts	Major/Temp. Minor/Prolonged	Major/Prolonged
DNRC	43	100%	0%	0%	0%
Federal	109	92%	2%	4%	2%
Industrial	101	99%	0%	1%	0%
NIPF	49	98%	2%	0%	0%
All Practices	302	96%	<1%	2%	<1%

**Table 12**  
**BMP Application and Effectiveness**  
**All vs. High Risk**

Application				
BMPs	Meet or Exceed	Minor Departure	Major Departure	Gross Neglect
All	97%	2%	<1%	0%
High Risk	93%	6%	1%	0%
Effectiveness				
BMPs	Meet or Exceed	Minor Departure	Major Departure	Gross Neglect
All	98%	<1%	1%	<1%
High Risk	96%	<1%	2%	<1%

### **Streamside Management Zones**

There is a different purpose in reviewing SMZ rules compared to BMP practices. They both are designed to protect water quality. However, conducting field reviews of SMZ law activities is a non-regulatory look at SMZ rules compliance, whereas BMPs are non-regulatory.

The SMZ rating form used in 2010 (last page of Appendix G) is identical to that used in the previous two field review cycles. In both years, the entries were modified to accept application and effectiveness ratings with a maximum of 12 practices rated on each site. The practices rated were taken from the SMZ rules. The scoring was the same as the 49 BMP practices with a five-point rating scale. **As with the BMPs in general, these ratings did not constitute an investigation or a DNRC enforcement action, nor were they used as a basis for future enforcement actions.** Field review team members evaluated departures based on their best professional judgment.

The SMZ law and rules were applicable to 37 of the 45 field review sites. Harvest of trees within riparian areas (not necessarily the SMZ) occurred on 37 of the 45 sites (Table 2). A total of 10 SMZ departures were noted on five of the sites. A total of 332 SMZ evaluations were made. SMZ rules were applied correctly 97% of the time. Of the 10 departures, 6 had minor impacts and 4 had major impacts (Table 15).

In the 2010 field review cycle a decision was made not to rate Practice 1b, SMZ properly marked. The general consensus from the teams was that this is very difficult to do accurately because ribbon lines are often torn down after a project is completed or they are torn down by cows, deer, or elk which seem to enjoy chewing on the ribbon. Also, some ribbon biodegrades before a field review may take place. Therefore, it was decided and approved by the BMP Working Group to drop this rating from the field review process.



**Table 13**  
**SMZ Departures by Ownership Group**

Ownership Group	Number of Sites Evaluated				Number of Sites with Departures				Total Number of Departures			
	2010	2008	2006	2004	2010	2008	2006	2004	2010	2008	2006	2004
<b>DNRC</b>	6	6	5	4	0	0	0	0	0	0	0	0
<b>Federal</b>	14	7	4	9	3	1	0	1	7	1	0	1
<b>Industrial</b>	12	17	20	19	1	3	4	3	2	10	7	3
<b>NIPF</b>	5	11	12	7	1	5	2	2	1	13	3	4
<b>All Sites</b>	37	41	41	39	5	9	6	6	10	24	10	8

Table 14 provides a summary and comparison of SMZ departures by practice.

**Table 14**  
**SMZ Application Departures by Practice**

Practice	Number of Departures
Equipment Operation in SMZ	4
SMZ Width Maintained	3
SMZ Maintained/Properly Marked	NOT RATED
Exclusion of Roadfill from SMZ	0
Sidecasting Material into Stream	1
SMZ Tree Retention	1
Exclude Construction of Roads in SMZ Except ≈	0
Site-Specific Alternative Practice	0
<b>TOTAL</b>	<b>10</b>

Table 15 provides a summary of application departures and effects.

**Table 15**  
**Summary of SMZ Departures and Effects**

Application			Effectiveness		
Number of Departures	Minor Departures (3)	Major Departures (2)	Number of Impacts	Minor/Temp. (3)	Major/Temp Minor/Prolonged (2)
10	6	4	6	5	1

SMZ effectiveness was very high, over 98 percent for all ownerships combined. Of the 332 SMZ evaluations, 326 provided adequate protection (4 rating); 5 impacts were Minor/Temporary (3 rating) and 1 impact rated Major/Temporary or Minor/Prolonged (2 rating). There were no Major and Prolonged impacts (1 rating).

## **SMZ Width**

In all cases, the SMZ width exceeded, met, or predominantly met the requirements of the SMZ law. Departures occurred on three sites where width was generally maintained, but marked improperly at some points or in some areas. Two of the sites had measurable impacts. These included equipment operation in the SMZ and inadequate tree retention. One site with improper marking did not have any departures during operations.

## **DISCUSSION**

### **Application Across All Ownerships**

Ninety-seven percent (97%) of the practices rated were properly applied according to BMP standards (Table 3). This percentage represents a slight increase from the 2008 overall rating of 96 percent, which continues to maintain an extremely high level of compliance. This percentage demonstrates the strong commitment all ownership groups have to properly applying BMPs and to sound forest management.

### **Effectiveness Across All Ownerships**

Ninety-eight percent (98%) of all applied BMPs were shown to be effective in preventing sediments from reaching draws or streams. The low percentage was 98% on Federal and NIPF lands and the high was 99% on DNRC and Industry lands

The most frequent departures and impacts were associated with road maintenance and road surface drainage. The following list ranks rated BMPs by the sum of departures and impacts. Practice III.C.1 is ranked #1 because it had more total departures and impacts than any other practice. Ties indicate BMPs with equal number of departures/impacts. See Appendix J for a listing of all BMPs where departures and impacts were recorded and the number of departures and impacts identified.

**Table 16**  
**BMPs Ranked by the Total Sum of Departures plus Impacts for Each Field Review Cycle**

<b>Practice #</b>	<b>BMP Description</b>	<b>2010</b>	<b>2008</b>	<b>2006</b>	<b>2004</b>	<b>2002</b>	<b>2000</b>	<b>1998</b>	<b>1996</b>	<b>1994</b>	<b>1992</b>	<b>1990</b>
III.C.1 *	Provide adequate road surface drainage for all roads	1	1	1	2	1	1	1	1	1	3	1
V.D.1	Culverts maintained to preserve hydrologic capacity	3	3	2	13	--	--	--	--	--	--	--
III.E.2 *	Maintain erosion control features (dips, ditches and culverts functional).	3	2	3	1	3	6	3	5	5	--	10
III.C.7 *	Route road drainage through adequate filtration zones before entering a stream	2	3	4	3	2	3	2	7	2	2	--
V.B.1b	Direct road drainage away from stream crossing site.	5	--	5	5	2	2	5	3	3	13	19
III.E.1	Grade roads as necessary to maintain drainage	--	--	6	16	--	--	--	--	--	--	--
IV.B.5*	Adequate drainage for skid trails	6	5	6	4	--	--	--	--	--	--	--
V.C.2	Stream crossing culverts conform to natural streambed and slope	--	--	6	--	--	--	--	--	--	--	--
IV.A.6.	Suitable location, size, and number of landings.	5	4	7	--	--	--	--	--	--	--	--
IV.A.5*	Design and locate skid trails to avoid concentrating runoff.	4	--	8	5	--	--	--	--	--	--	--
III.E.3	Avoid cutting the toe of cut slopes.	3	--	9	--	--	--	--	--	--	--	--
IV.B.4	Adequate drainage for landing.	5	4	--	--	--	--	--	--	--	--	--
III.C.3	Design of relief culverts.	6	6	--	--	--	--	--	--	--	--	--
III.D.2*	Stabilize Erodible Soils		6	--	--	--	--	--	--	--	--	--
V.C.4*	Prevent erosion from stream crossing culverts and bridges	3	--	--	--	--	--	--	--	--	--	--
III.D.5	Cut and fill slopes at stable angles	3	--	--	--	--	--	--	--	--	--	--
III.D.8	Waste material not entering stream	4	--	--	--	--	--	--	--	--	--	--
III.C.4	Install culverts at original gradient	6	--	--	--	--	--	--	--	--	--	--
III.C.5	Provide energy dissipaters at drainage structure outlets where needed	5	--	--	--	--	--	--	--	--	--	--
III.D.6	No woody debris in road fill	5	--	--	--	--	--	--	--	--	--	--
IV.B.2	Avoid operating equipment in isolated wetlands	6	--	--	--	--	--	--	--	--	--	--

\* Indicates "High Risk" BMPs.

The top four BMPs on the above list account for 50 percent of all departures and impacts. It can also be seen from this listing that the top four for 2008 were in a similar grouping.

The practices listed above for 2010 accounted for 100% of all departures and 77% of all impacts. Of 49 practices rated, 31 had zero departures or impacts. Seven of eight high risk BMPs had at least one departure.

It is interesting to note that in 2002, there were 133 total departures and impacts; in 2004 there were only 74; in 2006 it was 114, in 2008 we had 93, and in 2010 there were 62.

Combining application and effectiveness, the 2010 field reviews rated a total of 2,938 practices for the 45 sites. There were a combined total of 62 ratings with a departure or impact. **A departure or an impact occurred on 3 percent of all practices rated.** See Appendix J for a ranked summary of all departures and impacts by BMP for the 2010 field reviews.

### **Comparisons with Previous Field Reviews**

See Tables 17 and 18 for a comparison of overall field review results.

The 2010 reviews show a continuing improvement in results when compared to earlier years. There were slight decreases in a few categories. The changes were small and could reflect statistical variation.

**Table 17**  
**Comparison of 2010 BMP Field Review Findings with All Previous Results**

Category	2010	2008	2006	2004	2002	2000	1998	1996	1994	1992	1990
Application of practices that meet or exceed BMP requirements.	97%	97%	96%	97%	96%	96%	94%	92%	91%	87%	78%
Application of high risk practices that meet or exceed BMP requirements.	93%	90%	89%	89%	90%	92%	84%	81%	79%	72%	53%
Number of sites with at least one major departure in BMP application.	5 of 45 (11%)	8 of 42 (19%)	4 of 44 (9%)	5 of 39 (13%)	10 of 43 (23%)	4 of 42 (10%)	8 of 47 (17%)	12 of 44 (27%)	17 of 46 (37%)	20 of 46 (43%)	27 of 44 (61%)
Average number of departures in BMP application, per site.	0.87	1.19	1.52	1.30	1.80	1.40	2.00	3.00	3.90	5.60	9.00
Percentage of practices providing adequate protection.	98%	97%	97%	99%	97%	98%	96%	94%	93%	90%	80%
Percentage of high risk practices providing adequate protection.	96%	91%	92%	95%	92%	93%	89%	86%	83%	77%	58%
Number of sites having at least one major/ temporary or minor/ prolonged impacts.	7 of 45 (16%)	8 of 42 (19%)	7 of 44 (16%)	10 of 39 (25%)	15 of 43 (35%)	9 of 42 (21%)	12 of 47 (26%)	15 of 44 (34%)	13 of 46 (28%)	17 of 46 (37%)	28 of 44 (64%)
Average number of impacts per site.	0.47	1.02	1.05	0.56	1.30	1.00	1.50	2.30	3.00	4.60	8.00

### **Results by Ownership Group**

2010 field review results across all ownership groups were 94% or above for all BMP and SMZ categories (Table 19). Across all ownerships 3,602 ratings were made (2,938 BMP and 664 SMZ) with a total of 78 departures and impacts (62 BMP and 16 SMZ) for an overall compliance rating of 98%.

Given that all ownership groups demonstrated excellent overall compliance at the sites reviewed in 2010, there are some general observations that can be made for each. See Tables 9 and 19 and Appendix J for ownership comparison tables.

**Table 18**  
**Summarized Field Review Site Results 1990 Through 2010**

		2010	2008	2006	2004	2002	2000	1998	1996	1994	1992	1990
Application	Meets/Exceeds	97%	96%	96%	97%	96%	96%	94%	92%	91%	87%	78%
	Minor Departures	2%	4%	4%	3%	3%	3%	5%	7%	7%	8%	14%
	Major Departures	<1%	<1%	<1%	<1%	1%	0.3%	1%	1%	3%	4%	8%
Effectiveness	Adequate Protection	98%	97%	97%	99%	97%	98%	96%	94%	93%	90%	80%
	Minor Impacts	<1%	2%	2%	<1%	1%	2%	3%	4%	5%	6%	11%
	Major Impacts	2%	<1%	<1%	<1	2%	.07%	1%	2%	2%	4%	8%
% Sites	With Major Departures	11%	19%	9%	13%	23%	10%	17%	27%	37%	43%	61%
	With Major Impacts	16%	19%	16%	25%	35%	21%	26%	34%	28%	37%	64%
Average Departures	Minor Per Site	0.76	0.90	1.32	1.1	1.4	1.3	1.7	2.5	2.7	3.7	5.5
	Major Per Site	0.11	0.29	.20	0.26	0.39	0.12	0.34	0.55	1.1	1.4	2.5
Average Impacts	Minor Per Site	0.18	0.74	.66	0.26	0.58	0.71	1	1.6	2.1	2.8	4.4
	Major Per Site	0.29	0.29	.32	0.31	0.75	0.29	0.51	0.66	0.8	1.4	3.0

#### DNRC

All DNRC 2010 field review results were at 99% or above, slightly better than the 2008 results. Their number of sites with departures stayed the same at two. SMZ results remained the same at 100 percent for both Application and Effectiveness. For the high risk BMPs, Application “meets or exceeds” scores improved to 98%, up by 7% and Effectiveness “meets or exceeds” scores improved by 9 points to 100%.

#### Federal

Of the 16 federal sites, 14 were U.S. Forest Service and 2 were Bureau of Land Management. The federal scores were 96 percent and above. The Effectiveness score improved over the 2008 level while Application stayed constant. SMZ Application dropped from 99% from 94% and SMZ Effectiveness dropped from 99% to 95%. For high risk BMPs, the Federal agencies decreased their “meets or exceeds” scores from 89% to 87% for Application and increased them for Effectiveness from 91% to 92%.

#### Industry

Industry scored 98% for Application and 99% for Effectiveness of BMPs. This is a slight decrease from 2008. Industry showed a strong increase in SMZ Application scores rising to 100% from 94% with SMZ Effectiveness remaining unchanged at 98%. Industry was mixed on their “meets or exceeds” scores for high risk BMPs by going from 96% to 95% for Application and 96% to 99% for Effectiveness.

#### Non-Industrial Private Forest Landowners (NIPF)

NIPF sites showed more consistency in 2010 for their BMP/SMZ scores compared to previous reviews. Overall scores for BMP Application increased from 91% to 98%, and BMP Effectiveness increased from 92% to 99%. SMZ Application and Effectiveness both increased respectively from 89% and 92% in 2008 to 98% and 100% in 2010. For high risk BMPs, NIPF sites continued their strong showing by improving from 80% to 96 % for Application and from 81% to 98% for Effectiveness.

**Table 19**  
**Ownership Results Comparison 2008 and 2010**

Practice	DNRC		Federal		Industry		NIPF		Totals	
	2010	2008	2010	2008	2010	2008	2010	2008	2010	2008
BMP APPLICATION	99%	98%	96%	96%	98%	99%	98%	91%	97%	97%
BMP EFFECTIVENESS	99%	98%	98%	96%	99%	99%	99%	92%	98%	97%
SMZ APPLICATION	100%	100%	94%	99%	100%	94%	98%	89%	97%	94%
SMZ EFFECTIVENESS	100%	100%	95%	99%	98%	98%	100%	92%	98%	97%

### **Third Party Road and Other Use Implications**

In 2010 Field Review Team Members still noted a range of water quality impacts not resulting directly from sale being reviewed. Third party road impacts were observed at several field sites. Third party roads are roads not owned or directly controlled by the landowner being reviewed. Since the roads are not under the direct control of the participating landowner third party roads are not rated in the field review process. In order to qualitatively monitor BMPs associated with third party roads there is a location in Section VII of the field review form (Appendix E) where teams can record observations regarding third party roads. Several situations were noted where impacts were occurring because either roads were not adequately maintained by the road owner or roads were being used for another purpose, and that activity not related to the sale being reviewed was causing impacts.

### **Reductions in Overall Sediment Delivery**

The question was asked as to how this could be evaluated and the results presented in the Field Review Report. The BMP Technical Working Group decided to add a new question to the BMP Field Review Form (Appendix E). This new Yes/No question is found in Section VII of the Field Review Form and reads, "Project included road improvements to existing road system that reduced overall sediment delivery to streams." The teams were asked to do a visual qualitative assessment of each reviewed project's post-project road system and, when possible, determine if improvements resulted in a reduction in sediment delivery to streams. The 2010 field review results for this question are provided in Table 20.

**Table 20**  
**Overall Sediment Reduction – Pre vs. Post Project Condition**

Landowner	# Sites Reviewed	# Sites Applicable	Number Yes	Number No
DNRC	6	6	5	1
FEDERAL	16	16	9	7
INDUSTRY	15	15	6	9
NIPF	8	8	1	7
TOTALS	45	45	21	24

Results indicated 47% of the applicable sites reduced sediment delivery to streams from existing roads. This was compared to pre-project conditions. In these comparisons, an existing road system was in place prior to project commencement, and some sedimentation was occurring. During the course of the project, BMPs were implemented or brought up to BMP standards such that sediment delivery to draws or streams was reduced. A “No” response indicated that there were no opportunities to reduce sediment on existing roads. Possible causes are that there were either no pre-existing roads or that BMPs had already been applied to the existing road system and were adequately functioning.

Existing roads are defined as road systems in place prior to commencement of activities on the sale being reviewed. This question did not apply to project areas where roads were not in place prior to commencement of activities.

A “Yes” determination does not necessarily mean that there was no sediment delivery occurring post-project. A “Yes” indicates that the post-operations status regarding delivery has been improved over the original conditions. Likewise, a “No” determination does not mean that conditions have worsened, nor that no improvements were made to the existing road system. A “No” indicates that any improvements made did not lead to reductions over pre-project conditions.

## **OTHER BMP ISSUES OF NOTE**

### **Field Review Site Selection Process**

During the 2007 Legislative Session the EQC directed the Legislative Audit Division (LAD) to initiate a performance audit of the Department of Natural Resources and Conservation Forest Practices Program. This audit focused primarily on the BMP audit process.

The performance audit provided one recommendation as follows:

“Recommendation #1: We recommend DNRC, in conjunction with the BMP Technical Working Group; expand BMP audit selection criteria prior to the 2008 BMP audit cycle to audit/monitor a broader spectrum of timber harvest sites.”

Upon receipt of the performance audit results, DNRC responded with a request to move the implementation date to the 2010 field review cycle. This request was accepted.

The new selection criteria were used for the 2010 Field review site selections. The criteria are shown below.

### **2010 Site Selection Criteria as Adopted**

Minimum Criteria – all sites meeting these criteria must be submitted to DNRC

- Timber Harvest must have occurred within 2 years of the field review year. The field review window can be extended to three years prior to the field review year by DNRC if necessary to yield a sufficient population for a given ownership category.
- A portion of the sale must be located within 200 feet of a stream or have at least one Class I or II stream crossing on the road system associated with the harvest located on the ownership group’s



property within the reviewed project area or “”stream crossings are located on sections of road that “”the reviewed party has some maintenance responsibility on the road system within the reviewed project area.

- Minimum harvest size 5 acres.
- Minimum harvest removal west side 3,000bf/acre, east side 1,500 bf/ac. The continental divide acts as the rough boundary between east and west.

Prioritization Criteria – each site submitted would be given points based on the following matrix and the points for each site totaled.

- |   |          |
|---|----------|
| ○ Multiple new or replacement class 1 or 2 stream crossings | 5 points |
| ○ Single new or replaced Class 1 or 2 stream crossing       | 4 points |
| ○ New road construction                                     | 3 points |
| ○ Reconstruction  | 2 points |
| ○ SMZ Harvest   | 2 points |
| ○ Existing stream crossings                                 | 1 point  |

Note: new or replaced stream crossings must have been implemented in association with the harvest project within 5 years of the review year.

### **Fish Passage BMPs**

The BMP Working Group has created a matrix for measuring the effectiveness of newly installed Fish Passage culverts. The final process measures four separate parameters of the culvert installation. These are 1) The installation accommodates bankfull width (the mean high water) of the stream; 2) The installation mimics the natural slope of the stream; 3) The installation retains substrates (gravels, cobbles, etc.) that are representative of the typical streambed for the stream in that location; and 4) the installation retains water depth through the culvert that is consistent with the surrounding stream.

These four criteria are assessed on a Less Favorable – More Favorable scale. An average rating for the installation based on these four ratings is then developed. This rating system was implemented on a trial basis during the 2008 and 2010 Field Review Cycles. This was to give the field review teams opportunities to familiarize themselves with the process and to evaluate whether the rating criteria were practical to for the teams to implement. The feedback from the review teams is positive and these criteria will be used to measure new and replacement culvert installations that are associated with the timber sales being reviewed.

The results will be formally included in the published results beginning with the 2012 field review cycle. Beginning immediately the DNRC and other interested agencies, groups, and organizations will be involved in an educational effort to show potential timber harvesters (both loggers and landowners) how the new process will work and what criteria will be measured. The BMP Working Group approved the criteria, timing, and process during their November 2008 meeting.

## **CONCLUSIONS**

This final section addresses the data collected and analyzed. Conclusions will address the objectives of the Best Management Practices field reviews as outlined on page five.

### **Determine if BMPs are being applied on timber harvest operations.**

When considering sites meeting site selection criteria, it can be conclusively stated that BMPs are being applied correctly at a very high rate. There were no sites reviewed where evidence of BMP application was not present. BMPs continue to be the standard for timber harvest practices in Montana.

### **Evaluate the general effectiveness of BMPs in protecting soil and water resources.**

Conclusions drawn from the field review results over the past 20 years are very straightforward and consistent; when BMPs are applied correctly, they very effectively protect soil and water resources.

### **Provide information on the implementation of the SMZ law and rules and evaluate the general effectiveness of SMZs in protecting water quality.**

The 2010 field review data continues to show that the SMZ law and rules are being effectively applied across the state. This coincides with what we see in DNRC's SMZ enforcement program. DNRC enforcement records show that SMZ law and rule violations across the state are generally few and that the impacts associated with these violations are generally minor and that they can be very effectively mitigated/repaired. The 2010 field review data supports the contention that the SMZ law and rules are highly effective in protecting the state's water quality during timber harvest operations.

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# **APPENDIX A**

## **BEST MANAGEMENT PRACTICES FOR FORESTRY IN MONTANA**

**January 2006**

\* BMPs Not Monitored During Field Reviews

### **DEFINITIONS**

1. "Hazardous or toxic material" means substances which by their nature are dangerous to handle or dispose of, or a potential environmental contaminant, and includes petroleum products, pesticides, herbicides, chemicals, and biological wastes.
2. "Stream," as defined in 77-5-302(7), MCA, means a natural water course of perceptible extent that has a generally sandy or rocky bottom or definite banks and that confines and conducts continuously or intermittently flowing water.
3. "Streamside Management Zone (SMZ)" or "zone" as defined at 77-5-302(8), MCA means "the stream, lake, or other body of water and an adjacent area of varying width where management practices that might affect wildlife habitat or water quality, fish, or other aquatic resources need to be modified." The streamside management zone encompasses a strip at least 50 feet wide on each side of a stream, lake, or other body of water, measured from the ordinary high water mark, and extends beyond the high water mark to include wetlands and areas that provide additional protection in zones with steep slopes or erosive soils.
4. "Wetlands" mean those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include marshes, swamps, bogs, and similar areas.
5. Adjacent wetlands are wetlands within or adjoining the SMZ boundary. They are regulated under the SMZ law.
6. Isolated wetlands lie within the area of operation, outside of the SMZ boundary, and are not regulated under the SMZ law.

### **II. STREAMSIDE MANAGEMENT**

The Streamside Management Law (77-5-301 through 307 MCA) provides minimum regulatory standards for forest practices in streamside management zones (SMZ). The "Montana Guide to the Streamside Management Zone & Rules" is an excellent information source describing management opportunities and limitations within SMZs.

### **III. ROADS**

#### **A. Planning and Location**

1. Minimize the number of roads constructed in a watershed through comprehensive road planning, recognizing intermingled ownership and foreseeable future uses. Use existing roads, unless use of such roads would cause or aggravate an erosion problem.
2. Review available information and consult with professionals as necessary to help identify erodible soils and unstable areas, and to locate appropriate road surface materials.\*
3. Fit the road to the topography by locating roads on natural benches and following natural contours. Avoid long, steep road grades and narrow canyons.
4. Locate roads on stable geology, including well-drained soils and rock formations that tend to dip into the slope. Avoid slumps and slide-prone areas characterized by steep slopes, highly weathered bedrock, clay beds, concave slopes, hummocky topography, and rock layers that dip parallel to the slope. Avoid wet areas, including moisture-laden or unstable toe slopes, seeps, wetlands, wet meadows, and natural drainage channels.
5. Minimize the number of stream crossings and choose stable stream crossing sites.
6. Locate roads to provide access to suitable (relatively flat and well-drained) log landing areas to reduce soil disturbance.\*

#### **B. Design**

1. Properly design roads and drainage facilities to prevent potential water quality problems from road construction.\*
2. Design roads to the minimum standard necessary to accommodate anticipated use and equipment. The need for higher engineering standards can be alleviated through proper road-use management.
3. Design roads to balance cuts and fills or use full bench construction (no fill slope) where stable fill construction is not possible.\*
4. Design roads to minimize disruption of natural drainage patterns. Vary road grades to reduce concentrated flow in road drainage ditches, culverts, and on fill slopes and road surfaces.

- C. **Road Drainage.** Road Drainage is defined as all applied mechanisms for managing water in a non-stream crossing setting, road surface drainage, and overland flow; ditch relief, cross drains and drain dips)
1. Provide adequate drainage from the surface of all permanent and temporary roads. Use outsloped, insloped or crowned roads, and install proper drainage features. Space road drainage features so peak flow on road surfaces or in ditches will not exceed capacity.
    - a. Outsloped roads provide a means of dispersing water in a low-energy flow from the road surface. Outsloped roads are appropriate when fill slopes are stable, drainage will not flow directly into stream channels, and transportation safety can be met.
    - b. For in-sloped roads, plan ditch gradients steep enough, generally greater than 2% but less than 8%, to prevent sediment deposition and ditch erosion. The steeper gradients may be suitable for more stable soils; use the lower gradients for less stable soils.
    - c. Design and install road surface drainage features at adequate spacing to control erosion; steeper gradients require more frequent drainage features. Properly constructed drain dips can be an economical method of road surface drainage. Construct drain dips deep enough into the subgrade so that traffic will not obliterate them.
  2. Design all ephemeral draw culverts with adequate length to allow for road fill width. Minimum culvert size is 15 inch. Install culverts to prevent erosion of fill, seepage and failure as described in V.C.4 and maintain cover for culverts as described in V.C.6.
  3. Design all relief culverts with adequate length to allow for road fill width. Protect the inflow end of all relief culverts from plugging and armor if in erodible soil. When necessary construct catch basins with stable side slopes. Unless water flows from two directions, skew ditch relief culverts 20 to 30 degrees toward the inflow from the ditch to help maintain proper function.
  4. Where possible, install culverts at the gradient of the original ground slope; otherwise, armor outlets with rock or anchor downspouts to carry water safely across the fill slope.
  5. Provide energy dissipaters (rock piles, slash, log chunks, etc.) where necessary to reduce erosion at outlet of drainage features. Crossdrains, culverts, water bars, dips, and other drainage structures should not discharge onto erodible soils or fill slopes without outfall protection.

6. Prevent downslope movement of sediment by using sediment catch basins, drop inlets, changes in road grade, headwalls, or recessed cut slopes.\*
7. Route road drainage through adequate filtration zones or other sediment-settling structures to ensure sediment doesn't reach surface water. Install road drainage features above stream crossings to route discharge into filtration zones before entering a stream.

**D. Construction** (see also Section IV on stream crossings.)

1. Keep slope stabilization, erosion and sediment control work current with road construction. Install drainage features as part of the construction process, ensuring that drainage structures are fully functional. Complete or stabilize road sections within same operating season.\*
2. Stabilize erodible, exposed soils by seeding, compacting, riprapping, benching, mulching, or other suitable means.
3. At the toe of potentially erodible fill slopes, particularly near stream channels, pile slash in a row parallel to the road to trap sediment (example, slash filter windrow). When done concurrently with road construction, this is one method that can effectively control sediment movement, and it can also provide an economical way of disposing of roadway slash. Limit the height, width and length of "slash filter windrows" so wildlife movement is not impeded. Sediment fabric fences or other methods may be used if effective.
4. Minimize earthmoving activities when soils appear excessively wet. Do not disturb roadside vegetation more than necessary to maintain slope stability and to serve traffic needs.\*
5. Construct cut and fill slopes at stable angles to prevent sloughing and other subsequent erosion.
6. Avoid incorporating potentially unstable woody debris in the fill portion of the road prism. Where possible, leave existing rooted trees or shrubs at the toe of the fill slope to stabilize the fill.
7. Consider road surfacing to minimize erosion.\*
8. Place debris, overburden, and other waste materials associated with construction and maintenance activities in a location to avoid entry into streams. Include these waste areas in soil stabilization planning for the road.
9. Minimize sediment production from borrow pits and gravel sources through proper location, development and reclamation.

10. When using existing roads, reconstruct only to the extent necessary to provide adequate drainage and safety; avoid disturbing stable road surfaces. Prior to reconstruction of existing roads within the SMZ, refer to the SMZ law. Consider abandoning existing roads when their use would aggravate erosion.

**E. Maintenance**

1. Grade road surfaces only as often as necessary to maintain a stable running surface and adequate surface drainage.
2. Maintain erosion control features through periodic inspection and maintenance, including cleaning dips and crossdrains, repairing ditches, marking culvert inlets to aid in location, and clearing debris from culverts.
3. Avoid cutting the toe of cut slopes when grading roads, pulling ditches, or plowing snow.
4. When plowing snow, provide breaks in snow berm to allow road drainage.\*
5. Haul all excess material removed by maintenance operations to safe disposal sites and stabilize these sites to prevent erosion. Avoid sidecasting in locations where erosion will carry materials into a stream.\*
6. Avoid using roads during wet periods if such use would likely damage the road drainage features. Consider gates, barricades or signs to limit use of roads during spring break up or other wet periods.
7. Upon completion of seasonal operations, ensure that drainage features are fully functional. The road surface should be crowned, outsloped, insloped, or water-barred. Remove berms from the outside edge where runoff is channeled.\*
8. Leave abandoned roads in a condition that provides adequate drainage without further maintenance. Close these roads to traffic; reseed and/or scarify; and, if necessary, recontour and provide water bars or drain dips.

**IV. TIMBER HARVESTING, AND SITE PREPARATION**

**A. Harvest Design**

1. Plan timber harvest in consideration of your management objectives and the following\*:
  - a. Soils and erosion hazard identification.
  - b. Rainfall.
  - c. Topography.



- d. Silvicultural objectives.
  - e. Critical components (aspect, water courses, landform, etc.).
  - f. Habitat types.
  - g. Potential effects on water quality and beneficial water uses.
  - h. Watershed condition and cumulative effects of multiple timber management activities on water yield and sediment production.
  - i. Wildlife habitat.
2. Use the logging system that best fits the topography, soil type, and season, while minimizing soil disturbance and economically accomplishing silvicultural objectives.
  3. Use the economically feasible yarding system that will minimize road densities.\*
  4. Design and locate skid trails and skidding operations to minimize soil disturbance. Using designated skid trails is one means of limiting site disturbance and soil compaction. Consider the potential for erosion and possible alternative yarding systems prior to planning tractor skidding on steep or unstable slopes.\*
  5. Locate skid trails to avoid concentrating runoff and provide breaks in grade. Locate skid trails and landings away from natural drainage systems and divert runoff to stable areas. Limit the grade of constructed skid trails on geologically unstable, saturated, highly erosive, or easily compacted soils to a maximum of 30 percent. Use mitigating measures such as water bars and grass seeding to reduce erosion on skid trails.
  6. Minimize the size and number of landings to accommodate safe, economical operation. Avoid locating landings that require skidding across drainage bottoms.

**B. Other Harvesting Activities**

1. Tractor skid where compaction, displacement, and erosion will be minimized. Avoid tractor or wheeled skidding on unstable, wet, or easily compacted soils and on slopes that exceed 40 percent unless operation can be conducted without causing excessive erosion. Avoid skidding with the blade lowered. Suspend leading ends of logs during skidding whenever possible.
2. Avoid operation of wheeled or tracked equipment within isolated wetlands, except when the ground is frozen (see Section VI on winter logging).
3. Use directional felling or alternative skidding systems for harvest operations in isolated wetlands.\*

4. For each landing, provide and maintain a drainage system to control the dispersal of water and to prevent sediment from entering streams.
5. Ensure adequate drainage on skid trails to prevent erosion. On gentle slopes with slight disturbance, a light ground cover of slash, mulch or seed may be sufficient. Appropriate spacing between water bars is dependent on the soil type and slope of the skid trails. Timely implementation is important.
6. When existing vegetation is inadequate to prevent accelerated erosion, apply seed or construct water bars before the next growing season on skid trails, landings and fire trails. A light ground cover of slash or mulch will retard erosion.\*

**C. Slash Treatment and Site Preparation**

1. Rapid reforestation of harvested areas is encouraged to reestablish protective vegetation.\*
2. When treating slash, care should be taken to preserve the surface soil horizon by using appropriate techniques and equipment. Avoid use of dozers with angle blades.
3. Minimize or eliminate elongated exposure of soils up and down the slope during mechanical scarification.\*
4. Scarify the soil only to the extent necessary to meet the resource management objectives. Some slash and small brush should be left to slow surface runoff, return soil nutrients, and provide shade for seedlings.
5. Carry out brush piling and scarification when soils are frozen or dry enough to minimize compaction and displacement.
6. Carry out scarification on steep slopes in a manner that minimizes erosion. Broadcast burning and/or herbicide application is preferred means for site preparation, especially on slopes greater than 40%.
7. Remove all logging machinery debris to proper disposal site.\*
8. Limit water quality impacts of prescribed fire by constructing water bars in firelines; not placing slash in drainage features and avoiding intense fires unless needed to meet silvicultural goals. Avoid slash piles in the SMZ when using existing roads for landings.

## **V. STREAM CROSSINGS**

### **A. Legal Requirements**

1. Under the Natural Streambed and Land Preservation Act of 1975 (the "310 law"), any activity that would result in physical alteration or modification of a perennial stream, its bed or immediate banks must be approved in advance by the supervisors of the local conservation district. Permanent or temporary stream crossing structures, fords, riprapping or other bank stabilization measures, and culvert installations on perennial streams are some of the forestry-related projects subject to 310 permits.

Before beginning such a project, the operator must submit a permit application to the conservation district indicating the location, description, and project plans. The evaluation generally includes on-site review, and the permitting process may take up to 60 days.

2. Stream-crossing projects initiated by federal, state or local agencies are subject to approval under the "124 permit" process (administered by the Department of Fish, Wildlife and Parks), rather than the 310 permit.
3. A short-term exemption (3a authorization) from water quality standards is necessary unless waived by the Department of Fish, Wildlife and Parks as a condition of a 310 or 124 permit. Contact the Department of Environmental Quality in Helena at 444-2406 for additional information.

### **B. Design Considerations (Note: 310 permit required for perennial streams)**

1. Cross streams at right angles to the main channel if practical. Adjust the road grade to avoid the concentration of road drainage to stream crossings. Direct drainage flows away from the stream crossing site or into an adequate filter.
2. Avoid unimproved stream crossings. Depending on location, culverts, bridges and stable/reinforced fords may be used.

### **C. Installation of Stream Crossings (Note: 310 permit required for perennial streams.)**

1. Minimize stream channel disturbances and related sediment problems during construction of road and installation of stream crossing structures. Do not place erodible material into stream channels. Remove stockpiled material from high water zones. Locate temporary construction bypass roads in locations where the stream course will have minimal disturbance. Time construction activities to protect fisheries and water quality.

2. Design stream-crossings for adequate passage of fish (if present) with minimum impact on water quality. When using culverts to cross small streams, install those culverts to conform to the natural stream bed and slope on all perennial streams and on intermittent streams that support fish or that provides seasonal fish passage. Ensure fish movement is not impeded. Place culverts slightly below normal stream grade to avoid outfall barriers.
3. Do not alter stream channels upstream from culverts, unless necessary to protect fill or to prevent culvert blockage. On stream crossings, design for, at a minimum, the 25-year frequency runoff. Consider oversized pipe when debris loading may pose problems. Ensure sizing provides adequate length to allow for depth of road fill.
4. Install stream-crossing culverts to prevent erosion of fill. Compact the fill material to prevent seepage and failure. Armor the inlet and/or outlet with rock or other suitable material where feasible.
5. Consider dewatering stream crossing sites during culvert installation.\*
6. Maintain a 1-foot minimum cover for stream-crossing culverts 15 to 36 inches in diameter, and a cover of one-third diameter for larger culverts, to prevent crushing by traffic.
7. Use culverts with a minimum diameter of 15 inches for permanent stream crossings.\*

**D. Existing Stream Crossing**

1. Ensure stream crossing culverts have adequate length to allow for road fill width and are maintained to preserve their hydrologic capacity. To prevent erosion of fill, provide or maintain armoring at inlet and/or outlet with rock or other suitable material where feasible. Maintain fill over culvert as described in V.C. 6.

**VI. Winter Logging**

**A. General**

1. Consider snow-road construction and winter harvesting in isolated wetlands and other areas with high water tables or soil erosion and compaction hazards.\*
2. Conduct winter logging operations when the ground is frozen or snow cover is adequate (generally more than one foot) to prevent rutting or displacement of soil. Be prepared to suspend operations if conditions change rapidly, and when the erosion hazard becomes high.\*

3. Consult with operators experienced in winter logging techniques.\*

**B. Road Construction and Harvesting Considerations**

1. For road systems across areas of poor bearing capacity, consider hauling only during frozen periods. During cold weather, plow any snow cover off of the roadway to facilitate deep freezing of the road grade prior to hauling.\*
2. Before logging, mark existing culvert locations. During and after logging, make sure that all culverts and ditches are open and functional.\*
3. Use compacted snow for road beds in unroaded, wet or sensitive sites. Construct snow roads for single-entry harvests or for temporary roads.\*
4. In wet, unfrozen soil areas, use tractors or skidders to compact the snow for skid road locations only when adequate snow depth exists. Avoid steeper areas where frozen skid trails may be subject to erosion the next spring.\*
5. Return the following summer and build erosion barriers on any trails that are steep enough to erode.\*

**VII. HAZARDOUS SUBSTANCES**

**A. General**

1. Know and comply with regulations governing the storage, handling, application (including licensing of applicators), and disposal of hazardous substances. Follow all label instructions.
2. Develop a contingency plan for hazardous substance spills, including cleanup procedures and notification of the State Department of Environmental Quality.\*

**B. Pesticides and Herbicides**

1. Use an integrated approach to weed and pest control, including manual, biological, mechanical, preventive and chemical means.\*
2. To enhance effectiveness and prevent transport into streams, apply chemicals during appropriate weather conditions (generally calm and dry) and during the optimum time for control of the target pest or weed.\*

## **APPENDIX B**

### **2010 BMP FIELD REVIEWS REVIEWED SITES BY OWNERSHIP GROUP**

SITE #	SITE NAME	COUNTY	OWNER	FIELD REVIEW TEAM
STATE-1	Whiskey Gulch	Lewis & Clark	DNRC	Central/East
STATE-2	Point of Rocks	Flathead	DNRC	Northwest
STATE-3	Timber Creek	Mineral	DNRC	West
STATE-4	Cool Flat 4 X 4	Lewis & Clark	DNRC	West
STATE-5	Dog Valley	Sanders	DNRC	West
STATE-6	Three Creeks # 2	Lake	DNRC	West
FED-1	Main Boulder Fuels Unit 18	Sweet Grass	USFS	Central/East
FED-2	Teton Haz. Red. Salvage	Teton	USFS	Central/East
FED-3	Jimtown Fuels	Lewis & Clark	USFS	Central/East
FED-4	Gregg Plume Unit 81S	Flathead	USFS	Northwest
FED-5	Sylvia Ingalls Unit 100	Flathead	USFS	Northwest
FED-6	Sylvia Ingalls Unit 28	Flathead	USFS	Northwest
FED-7	Sylvia Ingalls Unit 59E	Flathead	USFS	Northwest
FED-8	Sylvia Ingalls Unit 99A	Flathead	USFS	Northwest
FED-9	Elk Brush Salvage Unit 8	Flathead	USFS	Northwest
FED-10	Pierce Fuels Unit 17	Missoula	USFS	West
FED-11	Brush Creek Fire Salvage	Lincoln	USFS	Northwest
FED-12	Bristow	Lincoln	USFS	Northwest
FED-13	Seeley Fuels	Missoula	USFS	West
FED-14	Hayes Creek Fuel Reduct.	Ravalli	USFS	West
FED-15	Deep Creek Pine Beetle	Deer Lodge	BLM	West
FED-16	Garnet Salvage	Missoula	BLM	West
IND-1	Spotted Dog 2009 Tractor	Powell	PVT	Central/East
IND-2	Bevis Line	Lincoln	PCTC	Northwest
IND-3	Cruien Line	Lincoln	PCTC	Northwest
IND-4	Himes Bayhorse	Lincoln	PCTC	Northwest
IND-5	Lucky 13	Flathead	PCTC	Northwest
IND-6	Seventh Heaven	Lincoln	PCTC	Northwest
IND-7	Turkey LP AD	Flathead	PCTC	Northwest
IND-8	Worm Sale	Flathead	PCTC	Northwest
IND-9	O'Neil North Ashley CTL	Flathead	Stoltze	Northwest
IND-10	O'Neil 32 Corner	Flathead	Stoltze	Northwest
IND-11	Sylvanite	Lincoln	Stimson	Northwest
IND-12	Calico LP Line	Sanders	PCTC	West
IND-13	Route 66	Missoula	PCTC	West
IND-14	BS-DNF	Granite	R-Y Timber	West
IND-15	Cabin Fever	Mineral	Stimson	West
NIPF-1	Mullan	Powell	PVT	Central/East
NIPF-2	Round Grove	Broadwater	PVT	Central/East
NIPF-3	Private	Lake	PVT	West
NIPF-4	Private	Missoula	PVT	West
NIPF-5	Private	Lake	PVT	West
NIPF-6	Private	Sanders	PVT	West
NIPF-7	Private	Missoula	PVT	West
NIPF-8	Private	Powell	PVT	West

## APPENDIX C

### **BMP FIELD REVIEW SITE INFORMATION FORM ALL OWNERSHIPS**

**A)** Please complete this sheet for each site that meets minimum criteria (see page 2 for instructions).

**B)** Please attach a sale area map for each site. Highlight or otherwise identify new road construction and/or reconstruction and Streamside Management Zones.

**C)** All references to streams and Streamside Management Zones (SMZ) are based on SMZ Law and 2006 Rules update, (see attached sheet).

#### **Minimum Criteria**

- 1) Timber harvested during **Calendar Years 2008 and 2009 and**
- 2) Some portion of the sale (cutting unit) is located within 200 feet of a stream or an access road crosses a class I or class II stream, **and**
- 3) Minimum size of 5 harvested acres with 3,000 BF/acre (westside), or 1,500 BF/acre (eastside) actually harvested. Continental divide determines east and west sides.

Sale Name \_\_\_\_\_

Landowner Type (circle one)      Federal      NIPF      Industry      State

Landowner Name \_\_\_\_\_ Phone # \_\_\_\_\_

MHRA Attachment      Yes      No      MHRA Holder Name \_\_\_\_\_

HRA Agreement Number      \_\_\_\_\_      County      \_\_\_\_\_

HRA Holder Name      \_\_\_\_\_      Phone #      \_\_\_\_\_

Legal Description      Section      \_\_\_\_\_      TWN      \_\_\_\_\_      RNG      \_\_\_\_\_

Acres Harvested      \_\_\_\_\_      Primary Drainage      \_\_\_\_\_

New Road Construction (Since 2003)      Yes      No      Miles      \_\_\_\_\_

Road Reconstruction/Deconstruction      Yes      No      Miles      \_\_\_\_\_

Slash Disposal Complete      Yes \_\_\_\_      No \_\_\_\_

Average MBF Volume/Acre Removed From Harvested Area      \_\_\_\_\_ MBF/Ac

New Stream Crossing Culvert Installation      Yes      No      Number of crossings      \_\_\_\_\_

Is new crossing on a fish bearing stream      Yes      No

Pre-Existing Stream Crossings On Access Road System Yes \_\_\_\_ No \_\_\_\_

Stream Within 200 Feet of a Harvest Unit      Yes \_\_\_\_      No \_\_\_\_

Riparian (SMZ) Harvest      Yes \_\_\_\_      No \_\_\_\_

Month/Year Harvest Conducted: From \_\_\_\_\_ To \_\_\_\_\_

Local Contact \_\_\_\_\_ Ph # \_\_\_\_\_

## **APPENDIX D**

### **BMP FIELD REVIEWS TEAM MEMBERSHIP 2010 CYCLE**

	<b>NORTHWEST</b>	<b>WEST</b>	<b>CENTRAL / EAST</b>
<b>FISHERIES</b>	Tom Weaver, DFWP + Leo Rosenthal, DFWP # Mike Hensler #	Shane Hendrickson + (Jim Bower, DNRC) + 2 (Katie Gaut, CFC) #	Trevor Selch, DFWP +
<b>HYDROLOGY</b>	(Dean Sirucek, USFS) + (Brian Sugden, PCTC) + 2 (Jeff Schmalenberg DNRC) +* Craig Kendall	<b>2 Gary Frank, DNRC +*</b> 2 (Christine Brick, CFC) # 2 (Katie Gaut, CFC) # 2 (Will McDowell, CFC) #	Mark Nienow, USFS + Wayne Green, USFS +
<b>SOILS</b>	Lou Kuennen, USFS + Dean Sirucek, USFS + <b>2 Jeff Schmalenberg DNRC +*</b> (Derek Milner) #	Wayne (Skip) Barndt +	Bob Logar NRCS +
<b>FORESTRY</b>	Paul McKenzie, Stoltze + (Dave Jones, DNRC) + Mark Boardman, Stoltze +	2 Dwight Crawford, SML + Jim Mountjoy + 2 Steve Hayes, BBER +	<b>2 Don Kasten, BIA +**</b> 2 Doug Mote + 2 (Steve Flynn, SML) # 2 (Dennis Davaz, R-Y Timber) + 2 (Dwight Crawford, SML) +
<b>ENGINEERING AND ROADS</b>	(Vic Andersen, PCTC) + 2 (Jeff Schmalenberg DNRC) +*	Beth Dodson # 2 Steve Hayes, BBER + 2 Rex Anderson, SML # 2 Dwight Crawford, SML + 2 Gary Frank, DNRC +*	<b>Gordy Sanders, PML +**</b> 2 (Dennis Davaz, R-Y Timber) + 2 (Steve Flynn, SML) # 2 Rex Anderson, SML # 2 (Dwight Crawford, SML) +
<b>CONSERVATION</b>		(Robert Benson, CFC) + 2 (Christine Brick, CFC) # 2 (Katie Gaut, CFC) # 2 (Will McDowell, CFC) #	
<b>NIPF/LOGGER</b>		Debra Parker Foley, MFOA + 2 Rex Anderson, SML #	Terry Mann, Logger + 2 Doug Mote + 2 Rex Anderson, SML # 2 Don Kasten, BIA +**
<b>OBSERVER</b>			

- + Denotes Past Experience
- \* Denotes Team Leader
- \*\* Denotes Co-Team Leader
- () Denotes Alternate Team Member
- # Denotes New Member
- 2 Denotes name is listed two or more times



# APPENDIX E

## BMP FIELD REVIEW FORM

DS-49  
Rev 1/04

### BMP FIELD REVIEWS SITE INFORMATION

Site Number: \_\_\_\_\_

Meets Selection Criteria: Y/N \_\_\_\_\_  
High Hazard: Y/N \_\_\_\_\_: Riparian \_\_\_\_\_ Matrix \_\_\_\_\_

Site Name: \_\_\_\_\_

Owner(s): \_\_\_\_\_

Legal Description: \_\_\_\_\_

County: \_\_\_\_\_

Primary Drainage: \_\_\_\_\_

Month/Year Harvested: \_\_\_\_\_

Stream Within 200 Ft.? Y / N

Name: \_\_\_\_\_

Bankfull Width: \_\_\_\_\_

Unit Size: \_\_\_\_\_

Volume Removed: \_\_\_\_\_

Road Construction: \_\_\_\_\_

Length: \_\_\_\_\_

Road Reconstruction: \_\_\_\_\_

Length: \_\_\_\_\_

Slash Disposal Complete: \_\_\_\_\_

Method: \_\_\_\_\_

Logging Method: \_\_\_\_\_

Slope: 0-5% \_\_\_\_\_; 5-20% \_\_\_\_\_; 20-40% \_\_\_\_\_; 40%+ \_\_\_\_\_

Parent Material: \_\_\_\_\_

#### Rating Guide

Soil Erodibility: High \_\_\_\_\_ Medium \_\_\_\_\_  
Low \_\_\_\_\_

Harvest in SMZ: Y / N

Stream Class: \_\_\_\_\_

Comments:

#### FIELD AUDIT

Date: \_\_\_\_\_

Team Leader/Recorder: \_\_\_\_\_

Team Members: \_\_\_\_\_

Observers Present: \_\_\_\_\_

#### APPLICATION

- 5—Operation Exceeds Requirements Of Bmp
- 4—Operation Meets Requirements Of Bmp
- 3—Minor Departure From Bmp
- 2—Major Departure From Bmp
- 1—Gross Neglect Of Bmp

#### EFFECTIVENESS

- 5—Improved Protection Of Soil And Water Resources Over Pre-Project Condition
- 4—Adequate Protection Of Soil And Water Resources
- 3—Minor And Temporary Impacts On Soil & Water Resources
- 2—Major And Temporary Or Minor And Prolonged Impacts On Soil And Water Resources.
- 1—Major And Prolonged Impacts On Soil And Water Resources.

#### DEFINITIONS (BY EXAMPLE)

- Adequate—Small amount of material eroded; Material does not reach draws, channels, or floodplain.
- Minor—Erosion and delivery of material to draws but not stream.
- Major—Erosion and subsequent delivery of sediment to stream or annual floodplain.
- Temporary—Impacts lasting one year or less; no more than one runoff season.
- Prolonged—Impacts lasting more than one year.

NR – Not Reviewed

NA – Not Applicable

# MONTANA FOREST PRACTICES REVIEW WORKSHEET

BMPs Applicable to:

- + New Road Construction
- # Existing Roads
- Reconstruction

RECOMMENDED BEST MANAGEMENT PRACTICES		APPLICABLE TO SITE (Y/N)			COMMENTS
		APPLICATION	EFFECTIVENESS		
<b>SECTION III—ROADS</b>					
<u>ROAD PLANNING &amp; LOCATION</u>					
<u>SECTION III. A.</u>					
➤+	1a. Minimize number of roads necessary.				
#	1b. Use existing roads unless aggravated erosion.				
+	3. Avoid long, sustained, steep road grades.				
+	4. Locations avoid high-hazard sites (i.e., wet areas and unstable slopes).				
+	5a. Minimize number of stream crossings. Number _____.				
+	5b. Choose stable stream crossing sites.				
<u>ROAD DESIGN</u>					
<u>SECTION III.B.</u>					
➤+	2. Design roads to minimum standard necessary to accommodate anticipated uses.				
+	4. Vary road grade to reduce concentrated drainage.				
<u>ROAD DRAINAGE</u>					
<u>SECTION III. C.</u>					
+➤#	1. Provide adequate road surface drainage for all roads.				
+➤	2. Design ephemeral draw culverts with adequate length and size and to prevent erosion of fill. Minimum size 15" maintain cover.				
+➤#	3. Design all relief culverts with adequate length and appropriate skew. Protect inflow end from erosion. Catch basins where appropriate.				
+➤#	4. Install culverts at original gradient, otherwise rock armour or anchor downspouts.				
+➤#	5. Provide energy dissipaters at drainage structure outlets where needed.				
+➤#	7. Route road drainage through adequate filtration zones before entering a stream.				

# MONTANA FOREST PRACTICES REVIEW WORKSHEET

BMPs Applicable to:

- + New Road Construction
- # Existing Roads
- Reconstruction

<u>CONSTRUCTION/RECONSTRUCTION</u> <u>SECTION III. D.</u>					
+➤	2. Stabilise erodible soils (i.e., seeding, benching, mulching).				
+➤	3. Provide effective sediment control on erodible fill slopes (ex. Slash filter windrow).				
+➤	5. Cut and fill slopes at stable angles. Slope ratio: _____.				
+➤	6. Avoid incorporating woody debris in road fill.				
+➤	8. Excess materials (waste) placed in locations that avoid entering stream.				
+➤	9. Sediment from borrow pits and gravel pits minimized.				
➤	10. Reconstruct only to the extent necessary to provide adequate drainage and safety.				
<u>ROAD MAINTENANCE</u> <u>SECTION III. E.</u>					
+➤#	1. Grade roads as necessary to maintain drainage.				
+➤#	2. Maintain erosion control features (dips, ditches and culverts functional).				
#	3. Avoid cutting the toe of cut slopes.				
+➤#	6. Avoid use of roads during wet periods and spring breakup.				
+➤#	8. Abandoned roads in condition to provided adequate drainage without further maintenance.				
<b>SECTION IV – TIMBER HARVESTING</b>					
<u>HARVEST DESIGN</u> <u>SECTION IV. A.</u>					
	2. Suitable logging system for topography, soil type and season of operation.				
	5. Design and locate skid trails to avoid concentrating runoff.				
	6. Suitable location, size, and number of landings.				

**MONTANA FOREST PRACTICES REVIEW WORKSHEET**

BMPs Applicable to:

+ New Road Construction

# Existing Roads

> Reconstruction

<u><b>OTHER HARVESTING ACTIVITIES</b></u> <u><b>SECTION IV. B.</b></u>					
1a.	Skidding operations minimizes soil compaction and displacement.				
1b.	Avoid tractor skidding on unstable slopes and slopes that exceed 40% unless not causing excessive erosion.				
2.	Avoid operation of equipment within isolated wetlands.				
4.	Adequate drainage for landing.				
5.	Adequate drainage for skid trails.				
<u><b>SLASH TREATMENT AND SITE PREPARATION</b></u> <u><b>SECTION IV. C.</b></u>					
2.	Treat slash so as to preserve the surface soil horizon.				
4.	Scarify only to the extent necessary to meet resource management objective.				
5.	Activities limited to frozen or dry conditions to minimize soil compaction and displacement.				
6.	Equipment operations on suitable slopes only.				
8.	Limit water quality impact of prescribed fire.				
<b>SECTION V – STREAM CROSSINGS</b>					
<u><b>LEGAL REQUIREMENTS</b></u> <u><b>SECTION V. A.</b></u>					
➤+	1. Proper permits for stream crossings.				
<u><b>DESIGN CONSIDERATIONS</b></u> <u><b>SECTION V. B.</b></u>					
➤+	1a. Cross streams at right angles, if practical.				
➤+	1b. Direct road drainage away from stream crossing site.				
➤+	2. Avoid unimproved stream crossings.				

**MONTANA FOREST PRACTICES REVIEW WORKSHEET**

BMPs Applicable to:

+ New Road Construction

# Existing Roads

> Reconstruction

<b><u>INSTALLATION OF STREAM CROSSINGS</u></b>					
<b><u>SECTION V. C.</u></b>					
>+	1. Minimize stream channel disturbance.				
>+	2. Stream crossing culverts conform to natural streambed and slope.				
>+	3. Proper sizing for stream crossing structures.				
>+	4. Prevent erosion of stream crossing culverts and bridge fills (i.e., armor inlet and outlet).				
>+	6. Minimum cover for stream crossing culverts provided.				
<b><u>EXISTING STREAM CROSSING</u></b>					
<b><u>SECTION V. D.</u></b>					
#	1. Culverts are maintained to preserve their hydrologic capacity. Adequate length to allow for road fill width. Rock armoring. Maintain fill over culvert.				
<b><u>SECTION VII – HAZARDOUS SUBSTANCE</u></b>					
<b><u>GENERAL</u></b>					
	1. Know and comply with regulations governing the storage, handling, etc. of hazardous substances.				
#	Project included road improvements to existing road system that reduced overall sediment delivery to streams.	Y/N Comment(s):			
+>#	Road system contains third party road systems.	Y/N Comment(s)			
<b>ADDITIONAL COMMENTS:</b>					

**MONTANA FOREST PRACTICES REVIEW WORKSHEET**

BMPs Applicable to:

+ New Road Construction

# Existing Roads

> Reconstruction

<b>STREAMSIDE MANAGEMENT ZONE SITE INFORMATION</b>				
<b>RECOMMENDED BEST MANAGEMENT PRACTICES</b>				<b>COMMENTS</b>
1a. Adequate SMZ width maintained, avg. width _____.				
1b. SMZ properly marked?				
2. Exclusion of broadcast burning in SMZ.				
3. SMZ retention tree requirements met. (# of trees, representative of pre-harvest stand, favor bank-edge and leaning trees, shrubs and sub merchantable).				
4. Exclusion of equipment operation in SMZ except on established roads.				
5. Exclude construction of roads in the SMZ except when necessary to cross a Stream or wetland.				
6. Exclusion of road fill material deposited in SMZ except as needed to construct crossings.				
7. Exclusion of side-casting of road material into a stream, lake, wetland or other body of water during road maintenance.				
8. Exclusion of slash in streams, lakes or other bodies of water.				
9. Exclude the handling, storage, application or disposal of hazardous or toxic materials in the SMZ in a manner that pollutes or causes damage or injury.				
10. Pre-approved alternative practices				
11. DNRC approved site-specific alternative practices.				

**ADDITIONAL COMMENTS:**

# **APPENDIX F**

## **FISH PASSAGE FIELD REVIEW FORM 2010**

Date: \_\_\_\_\_

Field Review Site Name: \_\_\_\_\_

Field Review Site Number: \_\_\_\_\_

<b>INSTALLATION OF STREAM CROSSINGS</b>				
<b>SECTION V. C.</b>	<b>COMMENTS</b>			
2. Design stream-crossings for adequate passage of fish (if present) and ensure fish passage is not impeded.				
** Stream crossing type and/or structure modification (fords, baffles, bridges).				
a. Structure width accommodates bankfull width. <div style="margin-left: 40px;">             Bankfull width        _____              Culvert width         _____              Constriction ratio    _____           </div>				
b. Structure slope mimics upstream and downstream slope <div style="margin-left: 40px;">             Channel slope        _____              Culvert slope         _____              Difference            _____           </div>				
c. Structure retains <u>substrates</u> representative of the upstream and downstream reaches and/or design material. <div style="margin-left: 40px;">             % of culvert bottom with substrate    _____           </div>				
d. Structure retains water depth representative of upstream and downstream reaches. <div style="margin-left: 40px;">             Channel water depth    _____              Culvert water depth    _____              Difference                _____           </div>				
<b>FISH PASSAGE SCORING TOTAL</b>	Application to Site (Y/N)	Application	Effectiveness	<b>OVERALL COMMENTS</b>
Design stream-crossings for adequate passage of fish (if present) with minimum impact on water quality. Ensure fish passage is not impeded				

# Application and Effectiveness Guidelines for 2010 Fish Passage BMP Field Reviews

## Application Rating

Design Criteria	Rating Guidelines (Examples)	Application Rating
V.c.2.a. - structure <u>width</u> accommodates bankfull width	$W_{\text{struct}}$ meets $W_{\text{bkf}}$ (Constriction Ratio $\geq 0.9$ ) <sup>1</sup>	MORE FAVORABLE
	$W_{\text{struct}}$ slightly constricts $W_{\text{bkf}}$ (Constriction Ratio 0.7 – 0.89) <sup>2</sup>	↓
	$W_{\text{bkf}}$ obviously not taken into consideration (Constriction Ratio $< 0.5$ )	LESS FAVORABLE
V.c.2.b. - Structure <u>slope</u> mimics upstream and downstream slope	Structure placed at stream grade (within $\pm 1\%$ ) <sup>2</sup>	MORE FAVORABLE
	Structure placed steeper/shallower than stream ( $\pm 1\% - 3\%$ )	↓
	Structure slope obviously not taken into consideration ( $> \pm 5\%$ )	LESS FAVORABLE
V.c.2.c. - Structure retains <u>substrates</u> representative of the upstream and downstream reaches and/or design material	Structure retaining material throughout the structure. (90-100%) <sup>2</sup>	MORE FAVORABLE
	Structure retaining material throughout a portion of structure (10-90%)	↓
	No substrate being retained and substrate not taken into consideration.	LESS FAVORABLE
V.c.2.d. - Structure retains <u>water depth</u> representative of upstream and downstream reaches	Water depth representative of stream channel <sup>2</sup>	MORE FAVORABLE
	Water depth slightly altered compared to stream channel ( $< 50\%$ change in depth)	↓
	No surface water found within structure or excessive surface water	LESS FAVORABLE MORE FAVORABLE
1 - Constriction Ratio = structure width divided by bankfull width (ex. 5' culvert/10' stream width = 0.5) 2 – Representative of the natural stream channel outside the zone of crossing-structure influence.		



# Application and Effectiveness Guidelines for 2010 Fish Passage BMP Field Reviews

## Effectiveness Rating

Fish Passage	Rating Guidelines (Examples)	Rating
<b>Design stream-crossings for adequate passage of fish (if present) with minimum impact on water quality. Ensure fish passage is not impeded</b>	Not applicable or possibly in the case of a replacement	5 - Improved Passage
	No passage concerns for local species at any time of year	4 - Adequate Passage
	Passage concerns due to minor application departures	3 - Minor and temporary Passage Impediment
	Passage concerns due to major application departures	2 - Major and temporary Passage Impediment
	Passage concerns for both low and high water flow	1 - Major and Prolonged Passage Impediment

### Field Review procedures and measurements:

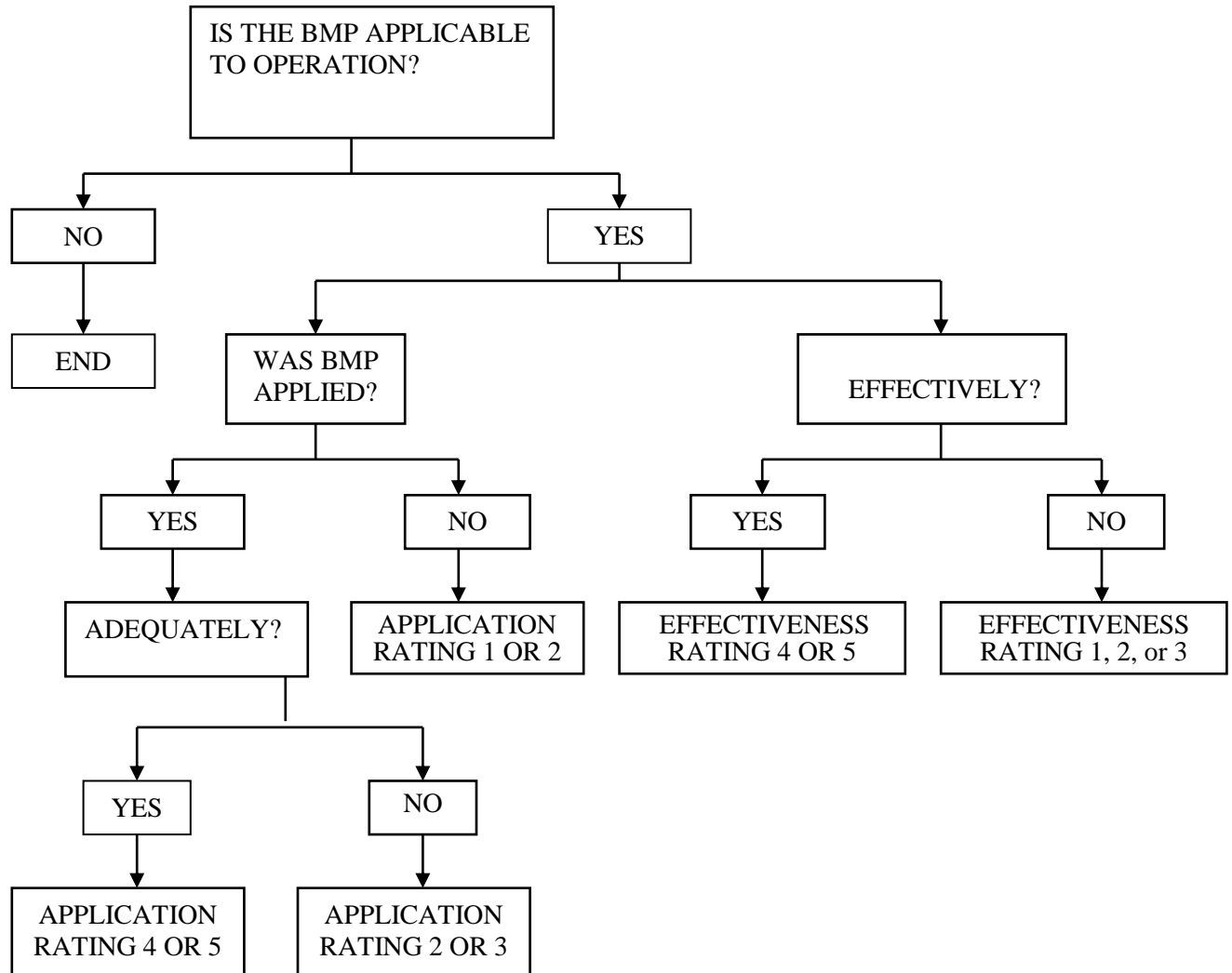
All measurements will be taken outside the zone of structure influence. (Except for culvert slope)

- Tape measurements of structure width and bankfull width.
  - Calculate constriction ratios (structure width/bankfull width)
    - Minimum of three measurements upstream and/or downstream at riffle sections, at bankfull width.
- Measurement of stream and structure slope (Clinometer)
  - Measure stream slope upstream and downstream of structure
    - Minimum of three measurements upstream and downstream, from riffle to riffle, measured in same direction.
- Substrate will be visually estimated, minimally
  - Keeping mind it is a human tendency to overestimate substrate size.
    - Consider substrates within 200 feet below and above structure. Estimate proportions of various size classes.
- Water depth will be measured with a wading staff
  - Minimum of three measurements upstream and downstream, measured at thalweg depth at bankfull width measure locations.

Detailed comments are required in order to elaborate and/or defend the effectiveness rating.

## **APPENDIX G**

### **BMP FIELD REVIEW RATING FLOW CHART**



# APPENDIX H

## 2010 BMP RATINGS BY PRACTICE AND OWNERSHIP

Practice	Owner	APPLICATION					EFFECTIVENESS				
		1	2	3	4	5	1	2	3	4	5
III.A.1a	DNR	0	0	0	6	0	0	0	0	6	0
	FED	0	0	0	11	1	0	0	0	11	1
	IND	0	0	0	8	0	0	0	0	8	0
	NIP	0	0	0	4	0	0	0	0	4	0
	<b>Total:</b>	0	0	0	29	1	0	0	0	29	1
III.A.1b	DNR	0	0	0	4	0	0	0	0	4	0
	FED	0	0	0	15	0	0	0	0	15	0
	IND	0	0	0	15	0	0	0	0	15	0
	NIP	0	0	0	6	0	0	0	0	6	0
	<b>Total:</b>	0	0	0	40	0	0	0	0	40	0
III.A.3	DNR	0	0	0	6	0	0	0	0	6	0
	FED	0	0	0	3	0	0	0	0	3	0
	IND	0	0	0	7	0	0	0	0	7	0
	NIP	0	0	0	3	0	0	0	0	3	0
	<b>Total:</b>	0	0	0	19	0	0	0	0	19	0
III.A.4	DNR	0	0	0	6	0	0	0	0	6	0
	FED	0	0	0	3	0	0	0	0	3	0
	IND	0	0	0	7	0	0	0	0	7	0
	NIP	0	0	0	3	0	0	0	0	3	0
	<b>Total:</b>	0	0	0	19	0	0	0	0	19	0
III.A.5a	DNR	0	0	0	4	0	0	0	0	4	0
	FED	0	0	0	2	0	0	0	0	2	0
	IND	0	0	0	4	0	0	0	0	4	0
	NIP	0	0	0	2	0	0	0	0	2	0
	<b>Total:</b>	0	0	0	12	0	0	0	0	12	0
III.A.5b	DNR	0	0	0	2	0	0	0	0	2	0
	FED	0	0	0	1	0	0	0	0	1	0
	IND	0	0	0	2	0	0	0	0	2	0
	NIP	0	0	0	1	0	0	0	0	1	0
	<b>Total:</b>	0	0	0	6	0	0	0	0	6	0
III.B.2	DNR	0	0	0	6	0	0	0	0	6	0
	FED	0	0	0	11	0	0	0	0	11	0
	IND	0	0	0	8	0	0	0	0	8	0
	NIP	0	0	0	4	0	0	0	0	4	0
	<b>Total:</b>	0	0	0	29	0	0	0	0	29	0
III.B.4	DNR	0	0	0	6	0	0	0	0	6	0
	FED	0	0	0	3	0	0	0	0	3	0
	IND	0	0	0	7	0	0	0	0	7	0
	NIP	0	0	0	3	0	0	0	0	3	0
	<b>Total:</b>	0	0	0	19	0	0	0	0	19	0

## 2010 BMP RATINGS BY PRACTICE AND OWNERSHIP

Practice	Owner	APPLICATION					EFFECTIVENESS				
		1	2	3	4	5	1	2	3	4	5
III.C.1	DNR	0	0	0	6	0	0	0	0	6	0
	FED	0	1	3	11	0	1	2	0	12	0
	IND	0	0	2	13	0	0	0	0	15	0
	NIP	0	0	0	7	0	0	0	0	7	0
	<b>Total:</b>	0	1	5	37	0	1	2	0	40	0
III.C.2	DNR	0	0	0	2	0	0	0	0	2	0
	FED	0	0	0	7	0	0	0	0	7	0
	IND	0	0	0	3	0	0	0	0	3	0
	NIP	0	0	0	0	0	0	0	0	0	0
	<b>Total:</b>	0	0	0	12	0	0	0	0	12	0
III.C.3	DNR	0	0	0	5	0	0	0	0	5	0
	FED	0	0	1	12	0	0	0	0	13	0
	IND	0	0	0	12	0	0	0	0	12	0
	NIP	0	0	0	0	0	0	0	0	0	0
	<b>Total:</b>	0	0	1	29	0	0	0	0	30	0
III.C.4	DNR	0	0	0	5	0	0	0	0	5	0
	FED	0	0	1	12	0	0	0	0	13	0
	IND	0	0	0	12	0	0	0	0	12	0
	NIP	0	0	0	0	0	0	0	0	0	0
	<b>Total:</b>	0	0	1	29	0	0	0	0	30	0
III.C.5	DNR	0	0	0	5	0	0	0	0	5	0
	FED	0	0	1	12	0	0	1	0	12	0
	IND	0	0	0	14	0	0	0	0	14	0
	NIP	0	0	0	3	0	0	0	0	3	0
	<b>Total:</b>	0	0	1	34	0	0	1	0	34	0
III.C.7	DNR	0	0	0	6	0	0	0	0	6	0
	FED	0	2	2	11	0	1	2	0	12	0
	IND	0	0	1	14	0	0	1	0	14	0
	NIP	0	0	0	6	0	0	0	1	5	0
	<b>Total:</b>	0	2	3	37	0	1	3	1	37	0
III.D.10	DNR	0	0	0	4	0	0	0	0	4	0
	FED	0	0	0	9	0	0	0	0	9	0
	IND	0	0	0	4	0	0	0	0	4	0
	NIP	0	0	0	2	0	0	0	0	2	0
	<b>Total:</b>	0	0	0	19	0	0	0	0	19	0
III.D.2	DNR	0	0	0	6	0	0	0	0	6	0
	FED	0	0	0	12	0	0	0	0	12	0
	IND	0	0	0	8	0	0	0	0	8	0
	NIP	0	0	0	4	0	0	0	0	4	0
	<b>Total:</b>	0	0	0	30	0	0	0	0	30	0

## 2010 BMP RATINGS BY PRACTICE AND OWNERSHIP

Practice	Owner	APPLICATION					EFFECTIVENESS				
		1	2	3	4	5	1	2	3	4	5
III.D.3	DNR	0	0	0	6	0	0	0	0	6	0
	FED	0	0	0	9	0	0	0	0	9	0
	IND	0	0	0	8	0	0	0	0	8	0
	NIP	0	0	0	4	0	0	0	0	4	0
	<b>Total:</b>	0	0	0	27	0	0	0	0	27	0
III.D.5	DNR	0	0	1	5	0	0	1	0	5	0
	FED	0	0	0	11	0	0	0	0	11	0
	IND	0	0	1	7	0	0	0	1	7	0
	NIP	0	0	0	4	0	0	0	0	4	0
	<b>Total:</b>	0	0	2	27	0	0	1	1	27	0
III.D.6	DNR	0	0	0	6	0	0	0	0	6	0
	FED	0	0	0	11	0	0	0	0	11	0
	IND	0	0	1	7	0	0	0	1	7	0
	NIP	0	0	0	4	0	0	0	0	4	0
	<b>Total:</b>	0	0	1	28	0	0	0	1	28	0
III.D.8	DNR	0	0	0	6	0	0	0	0	6	0
	FED	0	0	2	10	0	0	1	0	11	0
	IND	0	0	0	6	0	0	0	0	6	0
	NIP	0	0	0	3	0	0	0	0	3	0
	<b>Total:</b>	0	0	2	25	0	0	1	0	26	0
III.D.9	DNR	0	0	0	1	0	0	0	0	1	0
	FED	0	0	0	2	0	0	0	0	2	0
	IND	0	0	0	1	0	0	0	0	1	0
	NIP	0	0	0	2	0	0	0	0	2	0
	<b>Total:</b>	0	0	0	6	0	0	0	0	6	0
III.E.1	DNR	0	0	0	6	0	0	0	0	6	0
	FED	0	0	0	14	0	0	0	0	14	0
	IND	0	0	0	15	0	0	0	0	15	0
	NIP	0	0	0	7	0	0	0	0	7	0
	<b>Total:</b>	0	0	0	42	0	0	0	0	42	0
III.E.2	DNR	0	0	0	5	0	0	0	0	5	0
	FED	0	0	3	10	0	0	0	1	12	0
	IND	0	0	1	14	0	0	0	0	15	0
	NIP	0	0	0	6	0	0	0	0	6	0
	<b>Total:</b>	0	0	4	35	0	0	0	1	38	0
III.E.3	DNR	0	0	0	4	0	0	0	0	4	0
	FED	0	0	0	14	0	0	0	0	14	0
	IND	0	0	0	14	0	0	0	0	14	0
	NIP	0	0	0	7	0	0	0	0	7	0
	<b>Total:</b>	0	0	0	39	0	0	0	0	39	0

## 2010 BMP RATINGS BY PRACTICE AND OWNERSHIP

Practice	Owner	APPLICATION					EFFECTIVENESS				
		1	2	3	4	5	1	2	3	4	5
III.E.6	DNR	0	0	0	6	0	0	0	0	6	0
	FED	0	0	0	15	0	0	0	0	15	0
	IND	0	0	0	15	0	0	0	0	15	0
	NIP	0	0	0	7	0	0	0	0	7	0
	<b>Total:</b>	0	0	0	40	0	0	0	0	40	0
III.E.8	DNR	0	0	0	4	2	0	0	0	3	3
	FED	0	0	0	7	0	0	0	0	7	0
	IND	0	0	0	3	0	0	0	0	2	1
	NIP	0	0	0	0	0	0	0	0	0	0
	<b>Total:</b>	0	0	0	14	2	0	0	0	12	4
IV.A.2	DNR	0	0	0	6	0	0	0	0	6	0
	FED	0	0	0	16	0	0	0	0	16	0
	IND	0	0	0	15	0	0	0	0	15	0
	NIP	0	0	0	8	0	0	0	0	8	0
	<b>Total:</b>	0	0	0	45	0	0	0	0	45	0
IV.A.5	DNR	0	0	1	5	0	0	0	0	6	0
	FED	0	0	1	14	0	0	0	0	15	0
	IND	0	0	0	15	0	0	0	0	15	0
	NIP	0	0	1	7	0	0	0	0	8	0
	<b>Total:</b>	0	0	3	41	0	0	0	0	44	0
IV.A.6	DNR	0	0	0	6	0	0	0	0	6	0
	FED	0	1	0	15	0	0	1	0	15	0
	IND	0	0	0	15	0	0	0	0	15	0
	NIP	0	0	0	8	0	0	0	0	8	0
	<b>Total:</b>	0	1	0	44	0	0	1	0	44	0
IV.B.1a	DNR	0	0	0	6	0	0	0	0	6	0
	FED	0	0	0	16	0	0	0	0	16	0
	IND	0	0	0	15	0	0	0	0	15	0
	NIP	0	0	0	8	0	0	0	0	8	0
	<b>Total:</b>	0	0	0	45	0	0	0	0	45	0
IV.B.1b	DNR	0	0	0	6	0	0	0	0	6	0
	FED	0	0	0	15	1	0	0	0	16	0
	IND	0	0	1	13	0	0	0	1	13	0
	NIP	0	0	0	8	0	0	0	0	8	0
	<b>Total:</b>	0	0	1	42	1	0	0	1	43	0

## 2010 BMP RATINGS BY PRACTICE AND OWNERSHIP

Practice	Owner	APPLICATION					EFFECTIVENESS				
		1	2	3	4	5	1	2	3	4	5
IV.B.2	DNR	0	0	0	1	0	0	0	0	1	0
	FED	0	0	0	5	0	0	0	0	5	0
	IND	0	0	0	2	0	0	0	0	2	0
	NIP	0	0	1	6	0	0	0	0	7	0
	<b>Total:</b>	0	0	1	14	0	0	0	0	15	0
IV.B.4	DNR	0	0	0	6	0	0	0	0	6	0
	FED	0	1	0	15	0	0	1	0	15	0
	IND	0	0	0	15	0	0	0	0	15	0
	NIP	0	0	1	6	0	0	0	0	7	0
	<b>Total:</b>	0	1	1	42	0	0	1	0	43	0
IV.B.5	DNR	0	0	0	6	0	0	0	0	6	0
	FED	0	0	0	15	0	0	0	0	15	0
	IND	0	0	1	14	0	0	0	0	15	0
	NIP	0	0	0	8	0	0	0	0	8	0
	<b>Total:</b>	0	0	1	43	0	0	0	0	44	0
IV.C.2	DNR	0	0	0	5	0	0	0	0	5	0
	FED	0	0	0	16	0	0	0	0	16	0
	IND	0	0	0	15	0	0	0	0	15	0
	NIP	0	0	0	8	0	0	0	0	8	0
	<b>Total:</b>	0	0	0	44	0	0	0	0	44	0
IV.C.4	DNR	0	0	0	5	0	0	0	0	5	0
	FED	0	0	0	16	0	0	0	0	16	0
	IND	0	0	0	15	0	0	0	0	15	0
	NIP	0	0	0	8	0	0	0	0	8	0
	<b>Total:</b>	0	0	0	44	0	0	0	0	44	0
IV.C.5	DNR	0	0	0	5	0	0	0	0	5	0
	FED	0	0	0	16	0	0	0	0	16	0
	IND	0	0	0	15	0	0	0	0	15	0
	NIP	0	0	0	8	0	0	0	0	8	0
	<b>Total:</b>	0	0	0	44	0	0	0	0	44	0
IV.C.6	DNR	0	0	0	5	0	0	0	0	5	0
	FED	0	0	0	16	0	0	0	0	16	0
	IND	0	0	0	15	0	0	0	0	15	0
	NIP	0	0	0	8	0	0	0	0	8	0
	<b>Total:</b>	0	0	0	44	0	0	0	0	44	0
IV.C.8	DNR	0	0	0	4	0	0	0	0	4	0
	FED	0	0	0	14	0	0	0	0	14	0
	IND	0	0	0	14	0	0	0	0	14	0
	NIP	0	0	0	8	0	0	0	0	8	0
	<b>Total:</b>	0	0	0	40	0	0	0	0	40	0

## 2010 BMP RATINGS BY PRACTICE AND OWNERSHIP

Practice	Owner	APPLICATION					EFFECTIVENESS				
		1	2	3	4	5	1	2	3	4	5
V.A.1	DNR	0	0	0	5	0					
	FED	0	0	0	9	0					
	IND	0	0	0	3	0					
	NIP	0	0	0	2	0					
	<b>Total:</b>	0	0	0	19	0					
V.B.1a	DNR	0	0	0	3	0	0	0	0	3	0
	FED	0	0	0	10	0	0	0	0	10	0
	IND	0	0	0	3	0	0	0	0	3	0
	NIP	0	0	0	2	0	0	0	0	2	0
	<b>Total:</b>	0	0	0	18	0	0	0	0	18	0
V.B.1b	DNR	0	0	0	4	0	0	0	0	4	0
	FED	0	0	0	10	0	0	0	0	10	0
	IND	0	0	0	4	0	0	0	0	4	0
	NIP	0	0	0	2	0	0	0	0	2	0
	<b>Total:</b>	0	0	0	20	0	0	0	0	20	0
V.B.2	DNR	0	0	0	4	0	0	0	0	4	0
	FED	0	0	0	9	0	0	0	0	9	0
	IND	0	0	0	3	0	0	0	0	3	0
	NIP	0	0	0	2	0	0	0	0	2	0
	<b>Total:</b>	0	0	0	18	0	0	0	0	18	0
V.C.1	DNR	0	0	0	3	1	0	0	0	4	0
	FED	0	0	0	10	0	0	0	0	10	0
	IND	0	0	0	4	0	0	0	0	4	0
	NIP	0	0	0	1	1	0	0	0	1	1
	<b>Total:</b>	0	0	0	18	2	0	0	0	19	1
V.C.2	DNR	0	0	0	1	0	0	0	0	1	0
	FED	0	0	0	10	0	0	0	0	10	0
	IND	0	0	0	3	0	0	0	0	3	0
	NIP	0	0	0	2	0	0	0	0	2	0
	<b>Total:</b>	0	0	0	16	0	0	0	0	16	0
V.C.3	DNR	0	0	0	2	0	0	0	0	2	0
	FED	0	0	0	10	0	0	0	0	10	0
	IND	0	0	0	3	0	0	0	0	3	0
	NIP	0	0	0	2	0	0	0	0	2	0
	<b>Total:</b>	0	0	0	17	0	0	0	0	17	0
V.C.4	DNR	0	0	0	4	0	0	0	0	4	0
	FED	0	0	2	8	0	0	1	1	8	0
	IND	0	0	0	4	0	0	0	0	4	0
	NIP	0	0	1	1	0	0	0	0	2	0
	<b>Total:</b>	0	0	3	17	0	0	1	1	18	0



## 2010 BMP RATINGS BY PRACTICE AND OWNERSHIP

Practice	Owner	APPLICATION					EFFECTIVENESS				
		1	2	3	4	5	1	2	3	4	5
V.C.6	DNR	0	0	0	2	0	0	0	0	2	0
	FED	0	0	0	9	0	0	0	0	9	0
	IND	0	0	0	3	0	0	0	0	3	0
	NIP	0	0	0	2	0	0	0	0	2	0
	<b>Total:</b>	0	0	0	16	0	0	0	0	16	0
V.D.1	DNR	0	0	0	0	0	0	0	0	0	0
	FED	0	0	2	11	0	0	0	0	13	0
	IND	0	0	1	11	0	0	0	1	11	0
	NIP	0	0	1	0	0	0	0	1	0	0
	<b>Total:</b>	0	0	4	22	0	0	0	2	24	0
Hazardous Substances	DNR	0	0	0	6	0	0	0	0	6	0
	FED	0	0	0	16	0	0	0	0	16	0
	IND	0	0	0	15	0	0	0	0	15	0
	NIP	0	0	0	8	0	0	0	0	8	0
	<b>Total:</b>	0	0	0	45	0	0	0	0	45	0
<b>GRAND TOTAL:</b>		<b>0</b>	<b>5</b>	<b>34</b>	<b>1425</b>	<b>5</b>	<b>2</b>	<b>11</b>	<b>8</b>	<b>1442</b>	<b>6</b>
Practice	Owner	1	2	3	4	5	1	2	3	4	5
APPLICATION						EFFECTIVENESS					

## APPENDIX I

### SUMMARY OF 2010 FIELD REVIEW DEPARTURES AND IMPACTS BY BMP

BMP Sec	BMP Sub	BM P	APP 2	APP 3	APP Total	EFF 1	EFF 2	EFF 3	EFF Total	Grand Total
III	C	1	1	5	6	1	2	0	3	9
III	C	3	0	1	1	0	0	0	0	1
III	C	4	0	1	1	0	0	0	0	1
III	C	5	0	1	1	0	1	0	1	2
III	C	7	2	3	5	1	3	1	5	10
III	D	5	0	2	2	0	1	1	2	4
III	D	6	0	1	1	0	0	1	1	2
III	D	8	0	2	2	0	1	0	1	3
III	E	2	0	4	4	0	0	1	1	5
IV	A	5	0	3	3	0	0	0	0	3
IV	A	6	1	0	1	0	1	0	1	2
IV	B	1b	0	1	1	0	0	1	1	2
IV	B	2	0	1	1	0	0	0	0	1
IV	B	4	1	1	2	0	1	0	1	3
IV	B	5	0	1	1	0	0	0	0	1
V	C	4	0	3	3	0	1	1	2	5
V	D	1	0	4	4	0	0	2	2	6
Totals			5	34	39	2	11	8	21	60

\* - High Risk BMPs

# **APPENDIX J**

## **COMPARISON OF 2008 AND 2010 RESULTS**

### **Application of BMPs All Rated Practices by Ownership Group and Rating Category**

Ownership Group	Percentage (%) Practices Rated As									
	Number of Practices Rated		Meet or Exceed		Minor Departures		Major Departures		Gross Neglect	
	2010	2008	2010	2008	2010	2008	2010	2008	2010	2008
DNRC	227	252	99%	98%	1%	2%	0%	0%	0%	0%
Federal	554	276	96%	96%	3%	3%	1%	1%	0%	0%
Industrial	468	618	98%	99%	2%	1%	0%	0%	0%	0%
NIPF	220	301	97%	91%	3%	6%	0%	3%	0%	0%
All Sites	1,469	1,447	97%	97%	2%	3%	<1%	<1%	0%	0%

### **Field Review Sites with Application Departures And the Average Number of Departures per Site**

Ownership Group	Total # of Sites		Percentage (%) of Sites w/out Departures		Percentage (%) of Sites With Departures						Average Number of Departures per Site*					
			Meet or Exceed		Minor		Major		Gross Neglect		Minor		Major		Gross Neglect	
	2010	2008	2010	2008	2010	2008	2010	2008	2010	2008	2010	2008	2010	2008	2010	2008
DNRC	6	6	67%	67%	33%	33%	0%	0%	0%	0%	0.33	0.67	0.00	0.00	0.00	0.00
Federal	16	8	44%	37%	56%	63%	13%	25%	0%	0%	1.06	1.00	0.31	0.38	0.00	0.00
Industrial	15	17	47%	41%	47%	35%	0%	6%	0%	0%	0.60	0.41	0.00	0.06	0.00	0.00
NIPF	8	11	63%	27%	37%	64%	0%	45%	0%	0%	0.75	1.73	0.00	0.72	0.00	0.00
All Sites	45	42	51%	48%	47%	48%	4%	19%	0%	0%	0.76	0.90	0.11	0.29	0.00	0.00

**Effectiveness of BMPs for All Rated Practices  
by Ownership Group and Rating Category**

Ownership Group	Percentage (%) Practices Rated As									
	Number of Practices Rated		Adequate Protection		Minor/Temp. Impacts		Major/Temp., Minor/ Prolonged		Major/ Prolonged	
	2010	2008	2010	2008	2010	2008	2010	2008	2010	2008
DNRC	227	252	99%	98%	0%	2%	<1%	<1%	0%	0%
Federal	554	276	97%	96%	<1%	3%	2%	1%	<1%	0%
Industrial	468	618	99%	99%	1%	1%	<1%	<1%	0%	0%
NIPF	220	301	99%	91%	<1%	6%	0%	3%	0%	0%
All Sites	1469	1,447	98%	97%	<1%	2%	1%	<1%	<1%	0%

**Field Review Sites with Impacts (BMP Effectiveness)  
And the Average Number of Impacts per Site**

Ownership Group	Total # of Sites		Percentage (%) of Sites w/out Impacts		Percentage (%) of Sites With Impacts						Average Number of Impacts per Site*					
			Adequate or Improved Protection		Minor/ Temp.		Major/Temp. Minor/ Prolonged		Major/ Prolonged		Minor/ Temp.		Major/Temp p. Minor/ Prolonged		Major/ Prolonged	
	2010	2008	2010	2008	2010	2008	2010	2008	2010	2008	2010	2008	2010	2008	2010	2008
DNRC	6	6	83%	50%	0%	33%	17%	17%	0%	0%	0.00	0.67	0.17	0.17	0.00	0.00
Federal	16	8	56%	37%	13%	37%	25%	36%	13%	0%	0.13	0.37	0.56	0.75	0.13	0.00
Industrial	15	17	73%	59%	20%	29%	7%	6%	0%	0%	0.27	0.29	0.07	0.06	0.00	0.00
NIPF	8	11	75%	27%	25%	73%	0%	27%	0%	0%	0.25	1.73	0.00	0.36	0.00	0.00
All Sites	45	42	69%	45%	16%	43%	19%	19%	4%	0%	0.18	0.74	0.24	0.29	0.05	0.00